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A Retrospect.

A WHOLE year of war, and the conditions of life and of the world all unparalleled! When last we sat down to review a year's work in relation to the industrial interests in which our readers and ourselves are concerned, there had been five months of war—a mere foretaste of what was to follow, for what has followed has surpassed all human preconception. But, in those five months, the belligerent nations and the rest of the (how strange the word in relation to the conditions!) civilized world, had felt that they had lived an age. Those were the months in which hopes and fears were jumbled up confusedly, through the success of the Prussian Army in over-running Belgium and the North of France, and through the military preparedness of Germany and Austria, and the obvious deficiency of our own country and certain of our Allies, for land warfare, though on the sea the mastery was indisputably ours. Those were the months, too, in which chaos ruled in industry. But in the year now drawing to a close we have industrially settled down on to what appears to be bedrock conditions under the circumstances of the terrible and costly contest of mighty forces—costly in the fearful destruction of human life and property, and in the expenditure of the wealth of the nations engaged in the war. The price is great, but the cause of this country and of her Allies is just. The experiences, the episodes of, and the requirements in, the new warfare have largely during the year monopolized the minds of the peoples of all the world. The theatres of war have spread; the number of nations engaged has been increased. The hands of those nations arrayed against the tyrannism of Prussian militarism are full. Though the clouds are heavy in the Balkans, Mesopotamia, and the Dardanelles, the prospect to-day appears brighter than it has been at any period of the year; but while we look upon the position and the prospect as brighter, and as promising a speedier termination of the war than anyone dared to hope for but a few months since, still the events and incidents and changes in situation that have come upon us with such swiftness, and in such kaleidoscopic fashion, in the course of the year, naturally cause a judicious tempering of any certainty on the score of an early restoration of peace, though there is perfect confidence as to the ultimate end.

To this position we have arrived by a road of intense new warfare, marked by barbarities made possible by the advances of science. This appears paradoxical; but the truth is attested by occurrences of diabolical conception. On land, apart from the ordinary methods of warfare, the Germans introduced the demoniacal methods of producing death and suffering by gassing and flame; by sea they sought to shake the nerve of this and other countries by sending helpless men, women, and children to a watery grave by the use of the submarine, as witness the sinking of the "Lusitania," the "Arabic," and other liners. All this was nothing less than cowardly, calculated, cold-blooded murder, which caused shocks to run through the whole civilized world, and branded the German nation, or rather the rulers, as arch-fiends in the basest brutality. There was also the attack on unarmed merchant vessels and fishing boats, by which there was not only loss of vessels and cargoes, but further murder of helpless men. But the British Navy, by submarine captures and destruction, gradually weakened the enemy's power in this direction, and left them to rage over the spectacle of Britons undismayed. There was also the bombardment of unfortified towns on our coasts, and more murder of peaceful residents, including women and children. The British Navy, by the battle in the North Sea towards the end of January, and the loss it occasioned the German Navy, put an end to further exploits of a similar character. There have been the nocturnal raids by air, in which nothing of military importance has been achieved; but homes have been wrecked, and men, women, and children have been killed and maimed by bombs and fires. The Germans have proved themselves supreme masters in the art of cowardly and belial warfare; and their actions will not be speedily forgotten after the conclusion of peace. But amid it all, Great Britain and her Allies have proved their invincible courage, have evidenced their ability to conduct warfare according to the laws and the usages of civilized nations, have shown their power of resource in repairing any past defect in their equipment to meet a military organization which has taken decades to build up, and have exhibited their great financial resource, and their power to go forward as long as the enemy can hold out—and longer. The rulers of the enemy countries know this to-day; and they are well aware there is to be a day of reckoning.

There is confidence in this country and in those of her Allies, that not only in final defeat will all the barbarity of this war be fitly punished, but that before peace is declared our enemies will find themselves in an exhausted condition both economically and materially, and will be glad enough to relinquish, as part of the terms of peace, the lands which they are now holding while the process of exhaustion proceeds. They are in occupation of Belgium, a valuable portion of France, Poland, a part of Galicia, and Serbia. These are temporary possessions. They are causing this country to spend some millions sterling a day; but their own expenditure is greater. On the other hand, the failures of the enemy have been severe. Their armies have not fulfilled Prussian boasts that Paris, Calais, and Petrograd would fall into their hands. Egypt and the Suez Canal are not under German protection, as it was hoped by the enemy they would be. Germany has to scan the globe with minuteness to discover a possession that it can call its own outside Europe. There is German East Africa, but that is marked for conquest and change of proprietorship. Neither Germany nor Austria has any overseas trade; the overseas trade of the Allies is proceeding as usual. There is not a German ship sailing the seas to-day, thanks to the British Navy, which has sent to the bottom or destroyed every enemy warship that was openly afloat, and away from home refuges, at the beginning of the war. Our Navy was never stronger than at present, our Army was never greater or so well armed, and the country was never better organized for the production of munitions. It has been a case of a nation awakened; and the best use has been made of our old dormant resources in these directions. While the German nation has been fed by its masters on deception, and has experienced internal conditions growing worse and worse and visibly weakening daily, this country and her Allies have been day by day gaining in strength for the great and final struggle that must come—perhaps sooner than may to-day be generally expected. All over the globe, the nations are enriching themselves at the expense of Germany's and Austria's commercial impotence; and when these countries emerge from their confinement to again take part in outer affairs, they will look on a different world from that which they left seventeen months ago, and on people in it with vastly changed feelings towards them, and people less willing to trade with a nation that has had recourse to such foul work. Respect cannot exist under such circumstance; loathing can—and will.

WAR AND TRADE.

In the course of the year, the country has been busy in the direction of showing its capacity for making itself to large extent independent of the enemy countries, and to making more effective in many directions trade competition with those countries when the war terminates. To this end, under the *ægis* of the Government, various Committees have been appointed, and various industries have, through their own organizations, been discussing the position. All that

has been done, and all that has been talked about, in this connection makes too long a story for even brief telling here. But outstanding from it all has been the large recognition that has been given to the bringing of science into larger association with industry in order to develop it, and, through it, the prosperity of the country. But while the intentions of the Government are good in this respect, their idea of suitable financial assistance errs on the side of insufficiency. They have, for instance, appointed an Industrial and Scientific Research Committee and Advisory Council, who are to make a beginning in this important work with only an expenditure of £25,000 to £30,000 a year. In connection with the great dye scheme, which is eventually to give to this country what it ought to have had many years ago—a sufficient supply of dyes and colours of its own manufacture without foreign aid—the Government have promised for research only £100,000, to be spread over ten years; and yet the country has hitherto been spending millions of pounds a year in importing dye stuffs. In the matter of the Industrial and Scientific Research Committee, Professor W. A. Bone, F.R.S., sent an important letter to certain technical and other papers (the "JOURNAL" among them), urging what he conceived to be the lines of procedure that should be adopted in order to realize the maximum result from the governmental enterprise. The matter of correct foundations for such work is obviously of the utmost importance. There has also been during the year considerable discussion as to the proper organization of scientific bodies. It is at last recognized that there has been too much individual or independent procedure, and not sufficient co-operative effort, in connection with scientific work, with the result that the greatest good has not been derived from the brains and talent with which this country has been richly endowed. Therefore better organization in this respect is spoken of. A movement has also taken shape for the Federation of Employers' Associations, for the purposes stated in last week's issue.

How it is all going to work out, no one can yet tell; but it is hoped that the renaissance is a real one, and that there will not be a gradual slipping back until the plane of past conditions is once again reached. It is necessary that there should be immediate constructive work to produce after-effect; and many men have exercised their brains in this direction. Among them Mr. Charles Carpenter, D.Sc., in a paper read by him before the Society of Chemical Industry, expressed the view that every special industry should have its own scheme, or institute, of technology, not only for preparing workers for industrial operations, but with fully equipped resources to investigate the problems connected with industry; and over the various scientific centres, Mr. Carpenter would like to have a Royal College of Technology. It is something that the nation has at last been aroused to a recognition of what Professor Schuster, in his Presidential Address to the British Association, called the mutuality of scientific and business or industrial methods, and that the Government now admit by acts that they and their predecessors have been remiss in hitherto fostering the home industries from which flows the prosperity of the country. There we must leave the general subject; more extended details are on record in the volumes of the "JOURNAL" for the year.

Work is thus proceeding which will have a large bearing upon the future. But there is the present condition of the country's trade in which the gas industry is so deeply concerned, seeing that the degree of its fortunes has direct relation to the general industrial prosperity. While the ports of Germany and Austria have been closed against overseas trade through the will of the Allies, our own foreign trade has been going on much as usual, notwithstanding enemy submarines, and an abortive threat to "blockade" our shores so as to cripple mercantile shipping. Of course, the normal scale figures have not been achieved; but the Board of Trade returns give the information that, for the eleven months to the end of November last, our imports amounted to £782,940,937, which was an increase of £153,687,385 on 1914, and of £85,021,002 on 1913. Exports amounted to £350,699,817, being a decrease of £53,251,980 on 1914, and of £131,434,679 on 1913; while re-exports amounted to £91,095,222, which is an increase of £1,476,182 on 1914, and a decrease of £8,831,973 on 1913. But, of course, this is no measure of the activity of our home industries, owing to the large number of factories taken under control by the Ministry of Munitions throughout the country, and the extensive character of factories newly built solely for the production of war material. Nearly every factory throughout the country—the workshops of gas undertakings included—has been contributing to the work of turning out munitions of war; and thus it is that statistical data give very little indication as to the volume of work that has been accomplished in the country.

THE GAS INDUSTRY AND THE WAR.

The things that make up the affairs of our normal private and business lives have been thrown out of gear; and new interests and strange conditions have arisen. Each element in the work of the gas industry has had its circumstances so changed, that it is next to impossible to give a well-focussed view of the whole of its interests, experiences, and results during the year. They differ from the past; they differ as between the units of the industry owing to local circumstances. The same with prices of materials and secondary products. There are change and variety over all; therefore there must be in this retrospect more or less piecemeal treatment, and of as general a character as it can be made. There is one satisfaction; and it is that, by the work that was early done by the gas industry, it has been put on a more solid foundation under war conditions than existed during the first months of the war. A growing habit of the industry is to look after its own affairs, through its organized machinery, and not to let excess difficulty come upon it through default of sufficient action to secure remedy. What the industry has done during the year in this respect, it may be claimed, has had advantage for other industries.

THE SUPREME COAL TOPIC.

Pre-eminent in gravity, concern, and discussion, has been the position of coal supplies, prices, distribution, and transit costs. No one connected with the gas industry thought as the old year of 1914 closed that a position fraught with so much seriousness to the whole country—to industries especially, the gas industry included—would have developed so rapidly as it did. We seemed towards the end of the old year, and in the early weeks of the new one, to have been in a state of comparative calm, and future contract prices were untalked of that were more than a shilling or two above the contracts then running. But we had not marched far into the new year before, with a suddenness that was as suspicious as astonishing, everything in connection with coal supplies was for buyers in a state of turmoil. Supplies commenced to get erratic and to dwindle, shortage of output began to be talked about, railway difficulties owing to military needs started to swell in importance and effect, transport by sea was also upset, and therefore blameworthy; and, what was more, as the conditions increased in severity and consequence, so the coalowners, and some of the contractors and merchants, and shipowners took liberal advantage of the abnormal conditions, and started to enrich themselves to the national detriment. The most virtuous and patriotic thing in their minds was to make as much profit as possible—not merely a fair profit, to which no one had any objection—out of the country's necessities. What happened will for ever stand as a large blot upon the history of British commercial transactions. There were allegations afloat, too, that recourse was had in some quarters to artifices that were not over-reputable in order to make still more money. The exports of coal to neutral countries began to ascend. British ships had to stand by while an increasing number of ships flying neutral flags were seen departing laden with the precious coal that this country badly wanted. The returns as to exports to these neutral countries showed that, to certain of them, never before had so much coal been sent in corresponding periods; and there was open talk of much of the coal having its ultimate destination in Germany. The Government at first took no notice of this; but later came the Exports Regulation Committee, who did something to modify what was confidently believed to be partly illicit traffic. Still later further evidence that the Government were gravely suspicious was forthcoming when the rule was altered as to the nationality of a ship being denoted by its flag to ownership establishing nationality. There was also ample proof that certain coal contractors put large quantities of coal on the open market to secure the high prices that were being obtained from those who were compelled from sheer necessity to buy, while these same men were making short deliveries under their ordinary contracts, which, of course, were at lower prices per ton than the ruling market

prices. Nothing but contempt can be felt for those who treat contracts as mere "scraps of paper," when they find that they can reap monetary advantage by taking a mean course. However, happier than others were those gas undertakings that, profiting by their experiences during the great national coal strike of 1912, had large stocks of coal at command.

Of course, no one could deny that the output of coal had diminished, owing to the large number of miners who had joined the Colours; no one could deny that railway facilities and freights were bad; but most people were able to see other conditions which were the fruits of mercenary rather than patriotic action. At the same time, the indictment could not be established as a universal one in respect of those concerned in coal and shipping transactions; and it is only fair that this admission should be as freely made as the one that is as distasteful as it is discreditable. In regard to the conditions that arose (apart from coal supplies at the pits), in respect of transport and distribution, these were largely due to unavoidable circumstances through military requirements in connection with the railways, and to the regulations laid down for assisting in ensuring the safety of vessels, and the smaller available tonnage, through the commandeering of vessels by the Government, of which vessels, it was alleged, they did not make the best possible use. Opposed to these conditions, it was authoritatively stated, too, that the utmost use was not being made of the rolling stock on the railways, while from the side of those who spoke in defence of the railways came the allegation that, if consignees made every endeavour to release trucks quickly, there would be an enhancement of traffic. A good many purchasers of coal under contract only wished they could then have got the trucks to release; they would have been better off than they were through having to satisfy their requirements by going into the market and buying at ruinous prices. The condition again turned attention to the matter of the improvement of our waterways. Frequently, too, the question of pooling privately owned railway trucks was raised, and appeared to be taking definite shape towards the end of the year. But there were protests from all over the country; and a deputation to the Board of Trade received the assurance that nothing should be done during this session of Parliament, and that there should be consultation with representative owners before anything definite was arranged. In regard to coastwise deliveries, the restriction of running to daylight hours, the cargo-carrying ships of Germany and Austria being off the seas, and the Government appropriation of tonnage placed a larger burden upon our own shipping, so that seaborne deliveries of coal suffered, and extortionate freight rates were demanded. Of opportunity, better use was never made.

There were representations in regard to all these matters to the various Government Departments concerned. Lord Fisher was informed by Sir Corbet Woodall, D.Sc., the Governor of the Gas Light and Coke Company, as to the jeopardy to which the supply of gas to London was being exposed through the conditions obtaining in respect of the delivery of seaborne coal; and to the War Office, the Admiralty, and the Board of Trade, the Institution of Gas Engineers appealed, on behalf of the community and the industry, for action to be taken to improve supplies and deliveries. Courteous was the reply received by Sir Corbet from Lord Fisher; and assurances on all points were given to the Institution that the provision and maintenance of supplies were receiving the careful attention of the Government. It was also announced that steps were being taken whereby some of the interned enemy ships were to be used for facilitating the supply of coal to London. What occurred in this respect can be told in few words. Many of the ships—some of them gas companies' own ships, and vessels chartered by them—engaged in the bringing of coal from the Tyne to London, were commandeered by the Admiralty at the very beginning of the war; and freightage of 4s. per ton was all the recompense allowed. But when the interned vessels (which were not constructed for the economical reception and discharge of coal) were placed at the disposal of the large London coal purchasers, they were charged for at the inflated market rates then ruling. There were some strong protests; but protestations did not avail very much. The Government recognized the grievance; but, to all intents and purposes, they confessed themselves impotent to redress it. They could not, or would not, undercut the market freight rates, even to give justice to those whose more efficient transport facilities at much cheaper rates had been taken from them in the national service. What the Government expressed themselves as hopeful of was that the introduction of the interned vessels would result in an automatic reduction of freights. Just before this time, the London Coal Supply Advisory Committee was instituted, with Mr. D. Milne Watson as Chairman. The object was to advise the Government authorities on matters affecting the coal supply to the Metropolis. This Committee (which consisted of representatives of all the large coal-consuming interests in London—gas, electricity, water, docks, tramways, &c.) did energetic service in trying to improve matters. But really things went from bad to worse.

A Powerful Report.

Pressure was brought to bear on the Government from all quarters—for it was not only London that was suffering; but the whole of the United Kingdom. But London took a large part in providing the stimulus that eventually caused the Government to take action. At the latter part of the winter, the coal merchants of London had put their retail prices up to figures that inflicted a heavy burden upon the inhabitants of London, and especially on the poorer section of the community. While the coal merchants were exacting the last penny possible from the pockets of their hapless victims, they were also unconsciously arousing to action the Board of Trade. A Committee was appointed to consider the question of the retail prices of coal in London; but the effect of their inquiry had an importance for every coal user in every city, town, and village in the United Kingdom. The indictment by the Committee of those who have the handling of coal was complete. "The impression left upon our minds," said the Committee, "by the evidence and the information before us is that the conduct of an industry on which such great national interests depend cannot safely be left in the time of crisis to the working of an unregulated system of supply and demand. . . . We are not thinking alone of the comfort and convenience of the consumer, but of the vital importance to the safety, credit, and well-being of the country, of securing that its coal supply should, as regards quantity and price, be maintained at a level commensurate with national requirements." The Committee also showed that—though (at that time) 130,000 miners had joined the Colours, and though freights, railway, and cartage expenses had advanced through diminished facilities—all these things only justified an additional price of 3s. per ton, whereas London consumers had had to pay no less than 7s. to 11s. per ton extra. Then there were accusations of collusion between colliery owners and merchants whereby the former benefited to the extent of 6d. per ton for every 1s. additional per ton that the merchants could squeeze out of their customers. The Committee also condemned the action of the coal proprietors in diminishing deliveries under contract in order to put more coal on to the open market, and realize higher prices. The Committee also laid down the sensible principle that the nation should at a time like the present have first call upon the native coal supplies. They also recommended a restriction of exports to neutral countries, with a view to providing a more adequate supply. A further suggestion was that the rate of freight for interned steamers should be reduced to gas and other public utility companies in London. They also urged upon the Railway Executive Committee the adoption of every possible expedient to ensure the rapid transport of coal to London and the South. Finally, as to prices, it was suggested that, if these did not shortly return to a reasonable level, the Government should consider a scheme for assuming control of the output of collieries during the continuance of the war.

Potential Miners.

This report was an eye-opener for the Government; it was unpleasant reading for the coal proprietors and merchants; and it was too hard a nut for the apologists of the latter to crack. The Government could not really ignore the report; and it had large influence upon subsequent events, which were hastened by action primarily issuing from the gas industry. Conferences of representatives of gas undertakings were held in Glasgow and Manchester. The questions involved in the situation were debated up and down. Output of coal, irregularities in transit, prices, and the prospects for the then next [the present] winter were discussed. The position brooked no delay. If things were bad then, they would, it was recognized, be worse if allowed to drift

without anything being done. At these conferences it was suggested that section 4 of the Eight Hours Act should be suspended, in order to increase available supplies through extra working hours. But it may be admitted at once that this plan has not been adopted. Appointed by the Home Office was the Coal Mining Organizing Committee, with Sir Richard Redmayne, K.C.B., as Chairman. And their report showed conclusively that the position as to supplies was amenable to correction if the miners would only put in full time under existing conditions, seeing that (despite the fact that probably 190,000 miners had at this stage joined the army, which number is largely reduced by workers drafted into the mines from other industries) the demand on the mines was lessened by the considerable reduction of exports. The matter of the suspension of the Eight Hours Act was discussed several times; but strong objection was raised by both the colliery owners and the miners, on the ground of the difficulty that would ensue from any interference with present working conditions. At a Home Office conference, it was decided that the prevailing conditions should not be disturbed, but that all efforts should be made to reduce absenteeism. If this is not effectual, the matter of the suspension of the Act is to be revived. There is an evident strong reluctance on the part of the Government to do anything to which the miners could seriously object, as the Government and the country have had a taste of the power of the miners to do injury during the war, if selfishly and unpatriotically inclined—as witness South Wales on more than one occasion during the year.

Effective Movement.

However, there were deputations to the President of the Board of Trade by representatives of the gas industry; but nothing definite, beyond the weight and influence of the arguments advanced, immediately resulted. There was a larger movement to be made. It originated with the Manchester Institution; the proposal being that a national conference of the gas and electrical interests should be held, with the view of impressing upon the Government the dangerous position to which things were tending, and the perilous situation in which the community would find itself in regard to supplies of gas and electricity if something ameliorating was not speedily accomplished, and not only the community, but the nation, through the retarding of the work on munitions of war by reduction of the supplies of gas and electricity, and through the capacity of the gas industry in respect of toluol output being reduced—the extraction of which by that time was being performed at a large number of works. The suggestion matured. A conference of the gas and electrical interests was held at the Institution of Electrical Engineers, with Sir Corbet Woodall in the chair; and at the conference a representative Committee was appointed to lay the position before members of Parliament. Conferences were arranged; and, largely due to the irresistible influence of Mr. R. J. Neville-Neville, M.P., Chairman of the Brentford Gas Company, something like 200 members of Parliament assembled to hear what the deputation from the gas-electrical conference had to say. The legislators were impressed by the arguments laid before them; and particularly the one used by Mr. Charles Carpenter to the effect that, instead of the gas industry having to beg Parliament to help them in the matter of coal supplies, the Government should be begging (as they have been begging) the gas industry to help them more and more in the matter of the provision of high explosives. A Parliamentary Committee was appointed, of which Sir Corbet Woodall was also made a member, for the purpose of submitting to the Government the facts of the situation. This Committee, among other things, made a suggestion that the price of coal should be regulated, by taking the maximum pithead price paid for substantial quantities in each class of coal sold during the twelve months preceding the war, and adding 4s. 3d. per ton to cover increased costs due to the existence of the war. This was an improvement on the method suggested by the Board of Trade Committee, that the Government should assume control of the output.

Coal Prices.

Let us break off here to see what had been happening, and was still happening, outside the movement that was being made to secure parliamentary intervention. The coal owners were in regard to shortage of supply taking their stand on the enlistment of the miners, while opposed to this were the ascertained facts that the savings in export and full-time working on the part of the miners would give all that this country and its Allies needed, and still leave something over for business with neutral countries. As to prices, the coal owners pleaded the law of supply and demand, which highly abused "law" they were interpreting as a right to secure the uttermost farthing which the power of possession gave them, without consideration of abnormal circumstances and national interests. They were talking of 5s., 6s., and even 7s. 6d. per ton for new contracts. Mr. Runciman invited the coal owners to see him, and discuss the position. A result of this interview was a resolution by the owners: "This meeting of coal owners, having a desire to moderate the prices of coal for home consumption so far as may be practicable in the interests of the country, recommend that the question of the prices of such coal be considered by coal owners in the various districts with this object in view." The sincerity that underlay this resolution, and the fervour with which the "recommendation" was adopted, was not disclosed by what followed. And that the "desire" to subscribe to the interests of the country by a moderation of prices was quite a new-born one, and that brief life was its portion, is illustrated by the facts that the Midland coal owners only the week before circulated a recommendation that the contract price of gas coals should be raised 5s. or 6s. per ton throughout the country, and that just after this gas undertakings who were anxious to effect early contracts were compelled to pay advances from 5s. to 7s. 6d. per ton upon the prices of contracts then soon to expire. This alone, without calculating any of the attendant extra charges in the handling of the coal, meant 5d. to 7½d. extra per 1000 cubic feet of gas. In some cases, the contract prices were 60 to 75 per cent. higher than were being paid for certain classes of coal in 1909-11.

Those who entered into contracts between January and early in March were fortunate; for, taking Durham prices to illustrate the position, for best gas coals they were then varying between 12s. 3d. to 13s., and for second-class qualities from 11s. 9d. to 12s. 3d., while "Wear Specials" were 13s. to 13s. 6d. Then there was a sudden vertical flight; and by the beginning of April 22s. 6d., 21s., and 22s. 6d. to 23s. 6d. were being quoted for the three classes of coal just mentioned. By the beginning of May, another shilling or so had to be added to these prices. What possibly could have occurred in two or three weeks to have warranted half-a-sovereign and more being attached to pre-existing prices? Since then the quotations have shifted about within (say) 3s. or so below the April-May prices. But the quotations do not necessarily represent the prices paid under the Coal Prices Regulation Act, to be noticed presently.

The Burden of Freights.

At the same time, there was the ruinous position of rates of freight. Mention has been made of the non-interference of the Government in this matter, which is a mystery, and has never been satisfactorily explained, and of the protection which they exercised over the inflated market rates for freight by compelling the payment of these market rates for the use of interned enemy vessels. Before the war, freights from the Tyne to London were round about 2s. 9d. and 3s. per ton. There was an agreement by certain gas companies to pay an increase of 3s. per ton upon the contract rates, to cover the reduced earning capacity of the steamers owing to the restrictions on running, higher wages, increased fuel costs, and insurance against war risks. All computations show that this allowance generously covered all the extras, and so do the experiences of the London Gas Companies with their own vessels. Including all additional expenses occasioned by the war, as well as interest and depreciation, the Gas Light and Coke, the Commercial, and the Wandsworth Companies were, during the six months ending June, carrying coal in their own vessels at a cost of 3s. 2d. to 4s. odd per ton. But "market rates" went up to 10s. 6d., 11s., 12s. 6d., and other figures (even 17s. 6d. was once quoted) at different periods. Then down went the rate in the summer months (after the Coal Exports Regulation Committee had got well to work) to 7s. 6d., at which it remained, or thereabouts, for a time. Then it again rose until, at the time of writing, it is standing at the exorbitant figure of 14s. 6d. This is only an instance, for terribly high figures prevailed for all parts of the world; and gas companies abroad who were fortunate enough to get British coal were

unfortunate in the prices that they had to pay to get the coal to the nearest port to their works. At the meeting of the Continental Union Gas Company, as reported last week, it was stated that, while the normal rate of freight to Genoa was 8s. per ton, it had gone up to 66s. and 66s. 6d.—the difference representing, without the enhanced cost of coal, about 5s. per 1000 cubic feet. There was no question that tonnage was short; but there is equally no denying the fact that there was no "law" that put a limit upon the shipowners' demands, and that left them with a fair, instead of an exorbitant, profit on the service rendered. The nation suffered in consequence of this, and so did our Allies. Not until late in the year were Orders in Council issued which prohibited British ships carrying cargo from one foreign port to another foreign port, and appointed a Requisitioning Committee whose functions are to secure that tonnage shall be available, in case of need, for foodstuffs and other necessaries, and to prevent freights rising to prohibitive rates. What will be the effect of this Committee has yet to be seen. But the profits of cargo-carrying companies during the year have been phenomenal; and the market prices of their shares have risen to extraordinary figures. The high freights, combined with the high price of coal, have imposed a very heavy burden on gas undertakings relying on seaborne coal, and account for a large share of the considerable advances that have had to be made in the price of gas. Those companies who possess ships of their own were fortunate: and some of those who do so—such as the Gas Light and Commercial Companies—found it to their advantage, though high prices had to be paid, to purchase additional second-hand vessels. The South Metropolitan Company, who had hitherto only chartered vessels, also became owners. The Gas Light and Coke Company were unfortunate in having certain of their vessels torpedoed or mined—among them the large and comparatively new ship the "Fulgens." The smaller concerns who looked to water carriage for supplies were heavily hit, as they were helpless in the matter of becoming owners.

Coal Price Limitation.

From the facts given in the foregoing paragraphs may be traced the conditions that existed at the time representatives of the gas industry (with their Allies in the matter—the electricity industry, railway, tramway, water, dock, and other interests) had conferences, arranged deputations with the President of the Board of Trade, had meetings with members of Parliament, and came to the point where an unofficial Parliamentary Committee was appointed, which issued certain recommendations on the subject—an especially important one being that [to which reference has already been made] regarding a limitation of the price of coal. The effect of all this spade work and persistence was seen in the discussions in the House of Commons on the increases in the prices of public necessaries, and particularly in the discussions that took place when the President of the Board of Trade introduced his famous Price of Coal (Limitation) Bill, which gave Government recognition to what the Board of Trade Committee had recommended—that an essential like coal should not be (especially in times of national stress) without some form of control. The same thing had been advocated before by Sir Corbet Woodall, when coal prices took considerable upward flight after the coal strike of 1912; and by Sir Arthur Markham—himself a coal owner—when early in the year startling market and retail figures were showing themselves. Those who had made contracts prior to this were fortunate; afterwards, the disposition was to defer making contracts in the hope that the movement that had been inaugurated would result in the Government doing something effective. But some buyers took fright, and made contracts at prices several shillings above their last contracts. The upshot of it all was the Price Limitation Bill; and congratulations are due to Mr. Runciman for the firm manner in which he piloted that measure through Parliament, and resisted the opposition of the strong coterie of infuriated coal owners in the House who saw their liberty of bleeding the community through high coal prices in process of being effectually trammelled; and they also saw in it something ominous in respect of post-war freedom. A few Free Traders, too, were shocked at their principles being assailed; but their protests were couched in ineffectual words.

The chief feature of the measure as passed was that a standard price of 4s. per ton was allowed on the corresponding pithead rates of the year to June 30, 1914; it being calculated that 3s. would cover higher wages and additional colliery costs, leaving 1s. to meet exceptional cases. The 4s. increase means an enormous extra charge upon the nation. The President of the Board of Trade himself stated that 1s. increase on the home consumption of coal represented no less than £9,250,000 a year, and multiplying this by four, we have a startling figure. It means for the gas industry that the consumers of gas have to find for coal alone something like £3,500,000 extra a year. During the passage of the Bill through Parliament, a retrospective clause was inserted, which gave to local authorities and undertakers supplying gas, water, and electricity who had entered into contracts at high prices between April 1 and the commencement of the Act, the right to have the charges adjusted under the Act. Some gas undertakings within our knowledge had made contracts at 6s. to 7s. 6d. per ton higher than the prices of their preceding contracts. Recognizing the active and prominent part the gas industry had taken in obtaining statutory restriction, there was some fatuous retaliatory talk in the house, on the part of certain coal owners who ought to have known better, as to the residual products of gas undertakings being unlimited in price. But they got their quietus from Mr. Runciman, who pointed to the fact that divisible profits were limited in the case of gas undertakings, and those under the sliding-scale had to give the greater portion of their surplus profits to the consumers, before they could divide a small part of such profits among the shareholders.

Almost immediately after the Act came into operation, the coal owners tried their level-best to enter on a course of evasion by endeavouring to produce trouble by interpreting the Act in respect of the basis price in a manner never intended by the Government. The coalowners stated that they were advised by Counsel that the meaning of the words "the price of coal of the same description, sold in similar quantities, and *under similar conditions* affecting the sale at the pit's mouth, at the same coal mine, on the corresponding date," was that a day-by-day price was to be taken. The Lancashire Commercial Section communicated with the Board of Trade upon the subject; and the Board stated that, subject to special circumstances, "the corresponding price" would be "the price of coal sold under a contract corresponding to that under which the deliveries were being made." At the meeting of the Gas Companies' Protection Association, the Chairman (Mr. H. E. Jones) stated that the Association would be prepared to take up the matter if any of the members were inconvenienced by the coalowners insisting on their own curious interpretation.

However, this attempt at creating trouble having failed, the "Iron and Coal Trades Review" let out the secret of another possible movement, when it said in an editorial in November: "It would not be surprising if the collieries mainly dependent upon inland trade . . . sought some relief by applying to the Board of Trade, under clause 2 of section 1 of the Act, for permission to charge more than an advance of 4s. per ton upon corresponding prices."

Miners' Wages and a Strike.

In every section of the coal industry during the year, there was a largely prevalent disposition to make the very utmost possible out of the situation and the critical ordeal through which the country was passing. The burden of all the difficulties bore hardly on the whole community. The coal miners contributed their quota to the disturbance of things by exercising their numerical power in asking and insisting upon large consideration being showered upon them. They were not altogether to be blamed; they had before them the example of their masters. But the methods of the insistence of some were culpable—not in England, but in South Wales—for they jeopardized the country in the war and seriously threatened the continuity of our industries. Selfishness rode supreme.

Quite early in the year while other workers had almost generally conferred upon them something like a 10 per cent. war bonus, in respect of the higher cost of living, the coal miners—among the best paid men in the country—asked for a 20 per cent. war bonus. They held that the conditions were exceptional, and were not contemplated when the agreement under which they were working was entered into, which prohibited them asking for an advance before July. It was a long drawn-out business settling this matter. There were threats of a general strike if the 20 per cent. were not

conceded. Mr. Runciman took the matter in hand; then the Prime Minister, to whom it was eventually agreed the points at issue should be referred. Mr. Asquith did not give much sympathy to the claim for a universal advance of 20 per cent. He agreed, however, that a *primâ facie* case was made out for an advance; but that the decision as to its extent should be left to the various District Conciliation Boards and Sliding-Scale Committees. The result was that all the miners in the federated area of England obtained a 15½ per cent. war bonus, which is equivalent to 25 per cent. on the old wage standard of 1888, and 17½ per cent. on the new wage standard. The men of Northumberland and Durham received 15 per cent. on the 1879 standard; those of Scotland, 18¾ per cent. on the standard rates of 1888; and those of South Wales, 17½ per cent. on the 1879 standard. Then in the English Federated area in November, a further advance of 5 per cent. was conceded. Taking the earlier advance—the 15½ per cent.—in the Federated area, the "Iron and Coal Trades Review" estimated that it meant only 7d. or 8d. per ton; but the colliery owners began to add to the price of coal a substantial sum to "cover" this. But as the margin was a liberal one, it meant still extra profit. The total costs that were put upon the coal owners through the war, it was variously computed, amounted to 1s. 6d. to 2s. per ton. Mr. Runciman, from the information at the disposal of the Board of Trade, calculated (this was in July) that 3s., including the bonus, more than covered the extra costs per ton; so that, as already stated, the 4s. standard supplied a margin of 1s.

There was the strike in the South Wales field, which lasted a week, and was a very mischievous business, for which both masters and men ought to have been thoroughly ashamed of themselves. In the same field, the men again ceased work in August, owing to differences of opinion as to understandings and interpretations in relation to the agreement upon which they previously returned to work; and since then there have been frequent disputes, and local cessations of work. We will not go over the details of this sickening business, which absorbed much time of the country and of Cabinet Ministers in trying to adjust affairs. But the spectacle of these men stopping work while their comrades, through love of home and country, were facing death at the front, and were waiting for more and more munitions and all that the homeland could give to help in the heavy work lying before, was one which completely closed national sympathy against them. Throughout the year, the coal-mining world has been in a sensitive condition; and those concerned in it appeared to be constantly pulling in contrary directions.

Work of the Coal Exports Regulation Committee.

Allusion has been made to the establishment of the Coal Exports Regulation Committee, of which Mr. Russell Rea, M.P., is the Chairman. Acknowledgment must be made of the beneficial work accomplished by this Committee, which was not brought into being and operation a day too soon. The coalowners did not like it. There was a great deal of frothy talk as to the injury that would be done to the country through even the partial stoppage of exports to neutral countries, while at home supplies were deficient. It is wonderful how all the predictions of harm faded away with time. Soon after the war started, it was found that coal was going off at high prices to neutral countries in quantities unprecedented in times past; and much of the excess quantity of coal was not above suspicion as to its ultimate destination. The principle adopted by the Committee, in regulating the overseas coal trade, was the United Kingdom first, our Allies second, and then a very strict control over coal to neutral countries under the system of licences that was instituted. The stringency exercised as to licences had to be increased not only because coal was required at home, but on account of certain information which came to the knowledge of the Committee. The excellent effect of the work of the Committee was felt soon after it came into existence. While our Allies took more coal, and neutral countries could obtain less, the supply was materially increased for home use; storage began to assume normal conditions; ships for coastwise trade (in the summer months) were more plentiful, and home industries were generally able to breathe more freely. A few figures will be of interest. The quantity of coal exported in 1910 (excluding coal for shipping) was 62,085,476 tons; in 1911, 64,599,266 tons; in 1912, 64,444,395 tons; in 1913, 73,400,118 tons. In 1913, Germany took from us 8,973,920 tons. During the first year of the war—to July 31, 1915—the reduction in the quantity of coal exported, compared with the corresponding twelve months of 1913 to 1914, was 29,566,410 tons; but the Coal Exports Regulation Committee was only at work in the latter part of the first twelve months of the war. Since then, from Aug. 1 to Nov. 30 this year, there has been a reduction of 10,293,397 tons, compared with the corresponding four months of 1913. But, compared with the same four months of 1914, there has been an increase of 221,235 tons. But France has taken considerably larger quantities, and less coal has been allowed to go to neutral countries.

Gas companies operating in foreign lands, and who have hitherto been dependent upon British coals, suffered much not only from heavy freights, but—more particularly those at a distance—from the subsequent greater rigidity of control over exports. The British-owned companies in South America were acutely affected by the position. In Germany, gas-works that had formerly relied largely upon coal from this country had to turn entirely to German coals. Generally speaking, they do not appear to have suffered much in regard to supplies quantitatively; but some of them have done so in regard to supplies qualitatively. Certain of the coals delivered were high in their percentage of ash, and inferior in other respects; so that there was not complete happiness in respect of the quality of coke, which the community were advised, by high authority, should be used instead of coal. Holland furnished an interesting feature. For the control of the coal supplies, the Kolenbureau was established under the *ægis* of the Dutch Government; but in the Kolenbureau the Westphalian Coal Syndicate had more power than was pleasant for those Dutch merchants who were doing business with British coal. Information came that the intervention of the British Government was effecting the release from the domination of the Kolenbureau of those doing business in British coals; and then later there was a report that the Dutch Government were dissolving the Kolenbureau, and taking on themselves the control through a Committee, so as to free the coal position from German influence.

Fuel Economy.

Before leaving the subject of coal, there is another important question that has been projected well into view during the year which should be mentioned—that is, fuel economy. Through the periods of cheap coal, this country has grown most prodigal in its native primary resource; and progress and science have proved that the utmost use is not being made of the coal expended. It is one of the foremost of economic questions. Good service was rendered by Professor W. A. Bone, F.R.S., by introducing the topic at the meeting of the British Association this year, and giving to it a prominence that it much required, especially at this time, when there is so much being said as to the organization of our resources, and the improvement of our economic position. Waste overshadows the use of coal in every direction, but least, Professor Bone acknowledged, in the gas industry. He pointed to the waste in the domestic fireplace; but industry received his particular attention, and the coke-oven industry offered him illustration of promptly preventible waste. The beehive oven is a spendthrift of a disreputable order between coal income and coke product; and the bye-product plants are not, in the main, doing all they might do if proper chemical control were exercised over them. A Committee of scientists and technologists has been appointed by the British Association, through the instrumentality of Professor Bone, to investigate the question; and the Committee has power to add to its number by the selection of men whose knowledge of industrial matters will be helpful. The Committee should prove of national benefit. In the electricity industry, there is room for fuel economy by the greater extension of the employment of gas coke; and to this matter Mr. E. W. L. Nicol, the technical expert of the London Coke Sales Committee, has drawn attention. The British Commercial Gas Association lately appointed an Industrial Fuel Committee.

Oil.

There is little to be said about the oil position. Oil has considerably advanced in price in common with coal, owing to freights, the shortage of tank-steamers, and the general

upward tendency of all commodities. Gas companies who had contracts running under pre-war prices, or entered into before the shipping position made such an enormous difference in the situation, found themselves for a time in a very favourable position for making gas just as was best calculated to alleviate financially the abnormal conditions. Several concerns had oil in store at about 4d. per gallon, which was bad enough; but just lately they have been eking out this oil, with quotations (at the time of writing) standing at about 7d. per gallon. According to official returns, in 1912 the various petroleum products imported amounted to 413,333,358 gallons; in 1913, to 488,106,963 gallons; and in 1914, to 459,744,780 gallons. What the figures are likely to be for 1915 we have no information; but the complaint as to shortage of tank-steamers and the representations made to the Admiralty on the subject, lead one to anticipate that the imports will exhibit a decline. However that may be, the huge companies trading in oil seem to have had a very comfortable time, judging from the fact that the Shell Transport and Trading Company paid a dividend of 35 per cent. for the last complete year's trading, free of income-tax. The same Company have just paid an interim dividend for the current year of 10 per cent. free of income-tax, and state that, when the complete accounts are presented, there is reason to believe the results will not be inferior to those of the previous year. The last most important appearance made by the late Professor Vivian B. Lewes at the Royal Society of Arts was in connection with oil—"Motor Fuels" being his subject. Users of Diesel engines are feeling acutely the current high prices of oil fuel.

Residual Products—Coke.

The year has made one thing certain. It is that the gas industry is acquiring a new position in connection with its residual products; and the war has helped in the movement, through the shutting-off of supplies from Germany of certain necessaries to this country, the requirement of the country for more and more explosives, the cry for national economy, and the need for supplies of sulphate of ammonia for those markets in which Germany was operating before she found the British Navy an impediment in the path of her overseas trade. If the gas industry does not make the most of its present opportunities for consolidating its residuals position by organized effort, then it will show a deficiency of foresight. In a previous paragraph, reference was made to the London Coke Sales Committee and their expert Mr. E. W. L. Nicol. Our columns have shown that the work Mr. Nicol and the Committee are doing in establishing broader foundations for coke use (together with the British Commercial Gas Association) is of inestimable value for the industry. A gas engineering contributor to our pages who makes a special study—technically and commercially—of this branch of business has also done excellent service. The result of the co-operative effort, combined with local endeavour, is that more and more steam-boilers are being fed with coke, and more and more are being fitted with stoking appliances and forced draught, in order that coke may be used under them. But a good standard of purity for gas coke is required; and for the purpose it must be graded to proper size, on which points much information has appeared in our columns during the year. For motor buses and motor lorries, there has been application which shows that fuel costs with coke are lower per mile than when using Welsh coal or oil. In America, coke breeze is being used for locomotives on the Baltimore and Ohio Railway; and the results are said to be as good, with strong and forced draught appliances, as when using low-grade coal. Information has been given in the various articles we have published as to the evaporative power of coke and breeze; and for Scotch breeze figures have been supplied by Mr. W. R. Herring. There was some discussion in our columns as to the price at which coke breeze should be sold to electricity generating stations; the view being expressed that the full value of the breeze as a steam-raising agent should be paid, while, on the other hand, the opinion was held that an eye should be kept on the future when the fuel would not be so scarce as now, when prices would be lower, and when fuel competition would be keener. One matter about which some steam-boiler users have been extremely doubtful has been as to whether coke would have a greater deleterious effect upon their boilers than coal. Meldrum's Limited contributed to our columns important testimony on this point. During the past thirty years, they have fitted thousands of boilers for burning coke fuel; and, during this period, they have never heard of any deleterious effect on the boilers themselves. Boilers fitted with their furnaces twenty-five years ago are still in operation, and are working efficiently.

Before the London and Southern Junior Association, Professor Lewes again advocated low-temperature carbonization, in order to increase in the coke the average proportion of volatile matter to 4 or 5 per cent., which would, if commercially practicable, be a material improvement so far as the open grate is concerned. But Mr. Nicol subsequently pointed out that there would be no corresponding decrease in the proportion of ash in the coke, the presence of which is as much cause of its sullen behaviour as is the low percentage of volatile matter. It is doubtful whether any commercial advantage would be gained by adopting Professor Lewes's suggestion, in view of the loss of business in other directions; for the baker and horticulturist, for instance, the amount of volatile matter in coke as now produced is quite enough.

The free sale of coke, owing to the manner in which coal supplies were hung-up, and the high market and retail prices commanded for coal, caused effort in the local development of custom to slacken considerably. In the early part of the year, demand was great throughout the country; and those undertakings that had motor lorries available for the work experienced their commercial advantage, through quick distribution and the larger delivery radius they gave them. In London and some of the large centres with a considerable poor population, queues of poor people were in the latter part of the winter of 1914-15 to be seen outside gas-works early in the morning waiting for small supplies of fuel. In some districts, too, coke supplied in 14-lb. and 28-lb. bags was very popular. Though the cultivation of local demand is all-important—looking at past experience and in anticipation of history repeating itself after the war, inasmuch as the production of coke is more likely to increase than lessen—there are some gas managements that still prefer not to be troubled with small local transactions. No doubt in consequence of this antipathy, or partly so, there was an amount of complaint at different Association meetings as to raids by gas undertakings with coke into other gas-supply districts—sometimes situated quite a distance away. There were complaints from the Eastern counties and from Scotland; and at one of the meetings of the Lancaster Town Council, it was asserted that the price of coke had had to be reduced owing to competition in the town by other gas undertakings. It was found too that certain gas undertakings represented in one Commercial Gas Section competed in the areas of gas undertakings represented in another Commercial Gas Section. This is leading to dissatisfaction. Gas-works in the north-eastern areas especially have developed a large coke trade abroad. Mr. Thomas Waddom, in his Presidential Address to the North of England Gas Managers' Association, stated that in the previous two years no less than 74 and 68·8 per cent. of the coke production of the Newcastle and Gateshead Gas Company had been exported. He complained of the restrictions to export which have been placed upon coke by the Coal Exports Committee, as did also Mr. A. W. Branson, of Hartlepool, in his Presidential Address to the Welsh Gas Association, to which office he was elected before his transfer northward.

Reverting to the domestic use of coke, less was heard during the year of installations of coke boilers for hot-water. But excellent experiences of coke as an economical agent for this purpose are being obtained; and it is only a case of suspended animation that more has not been heard of developments this year. There will be a revival after the war. Dr. A. Vernon Harcourt, F.R.S., gave, at the Royal Society of Arts, some interesting experiences as to personal use of coke in specially designed grates in the rooms of his own house. A good amount of attention was devoted to the utilization of coke dust for briquette making. It was a point at the Cardiff Trade Development Conference; a plant, it was reported, has been ordered for the Smethwick Gas-Works; and in our columns appeared accounts of what was being done in this regard at the Kolberg and Nuremberg Gas-Works.

There is little use referring specifically to the prices obtained for coke. They varied so much according to local circumstances. But prices (which recovered well towards the end of the second half of 1914) were good in the earlier part of the year; and for years stocks have not been so low

at June 30 as they were this year—in fact, many works in the earlier part of the first half frequently found themselves with clear yards. But during July, August, and September stocks again began to accumulate in some districts. This was only natural. Prices went up considerably; and they continued to rule at high levels in common with coal. In the autumn, manufacturers and other large users of coke commenced once more to stock preparatory for the winter; and in the closing months of the year, especially when the cold weather set in, local demand again ascended. The coke business was one which during the year gave little concern, which is an experience that has not been the lot of the industry for some years.

According to the prices, f.o.b. Tyne, given by our Northern coal trade correspondent, the year started at from 11s. to 12s. per ton; but prices did not make the same sharp ascent in the spring as did coal. They moved up gradually till in May and June 19s. to 20s. ruled. By August 26s. to 27s. was quoted; and until the end of the year prices varied between these figures and 30s.

Tar, Dehydration, and Toluol.

For several reasons, tar, like coal, has been in great prominence during the year. It has taken a place among exigent national requirements that has given to it an unaccustomed status. Producers wish this status applied also to the commercial position of the product. The former condition is due to the requirement for benzol, toluol, and other products necessary to the manufacture of explosives, and to the need for intermediate products for dye and colour making. But the tar market generally was not in good form, owing to the dropping-off of the foreign demand for pitch principally for briquette making, and the impossibility of shipping pitch owing to the high freights. As a matter of fact, pitch at the price at which it could be delivered abroad put briquette-making other than with local materials entirely out of the range of practicability. As already mentioned, briquette-making has been the subject of much consideration at home; and this may become a new branch in gas-works operations, as in several places on the Continent. The matter was particularly emphasized by Mr. W. J. A. Butterfield, M.A., F.I.C., in a paper that he read at the Cardiff Trade Conference. Early in the year, it was announced that the Yorkshire tar distillers and producers had arrived, shortly after the outbreak of war, at an amicable understanding on the subject of pitch. Under the arrangement, pitch was not to be sold at less than 34s. a ton without the consent of the tar producer, and a sum approximately equal to the value of the liquid products was to be paid on account of each ton of raw tar delivered. But this arrangement was not a general one. Stocks of pitch continued to increase considerably; and the prices that were commanded fluctuated largely according to conditions—so much so that between quotations and prices actually obtained for the material (say, as between London and the provinces) there was such wide divergence that much trouble with buyers and sellers soon ensued. Another thing that was against tar was that road authorities, owing to the financial conditions and the need for economy, refrained to a very great extent from their annual custom of tar-spraying roads, and the stoppage of grants by the Road Board (whose funds have been temporarily diverted to other national purposes) did not encourage the work. Moreover, the use of crude tar on the roads was forbidden. The result of this was that refined tar was not in some cases, owing to the absence of dehydration plants at gas-works, locally available, and to obtain it from distillers would in many cases have meant considerable cost in carriage. Notwithstanding the prohibition as to the use of the crude tar, it came to the knowledge of the Ministry of Munitions that a quantity was being employed; and, towards the end of the year, Mr. H. P. Maybury, the Manager and Engineer to the Road Board, issued circulars urging obedience to the instructions.

It happens that the requirements of the Ministry of Munitions in respect of tar fit in well with the provision of the most suitable tar for road purposes. The application of the "C" process for increasing the quantity of benzol and toluol in tar by washing the gas has resulted in a considerable development in the treatment of tar in gas-works, by the adoption of first-stage tar distillation or dehydration. The temperature at which distillation has to be carried on to comply with the order that the whole of the toluol should be removed from the tar along with a quantity of the phenols is just that which causes the tar to comply with the Road Board's specification for road-dressing purposes. Had it not been for this large adoption of tar dehydration in gas-works, the tar distillers would have had difficulty in meeting the huge demands for toluol made by the Ministry of Munitions. However, this development in tar dehydration has brought under reconsideration the question of going further in the process by adopting the next-stage process of rectification and fractionation of the light oils; and additional gas engineers have commenced to debate in their own minds the matter of adopting complete tar distillation. The proposal has also been made that groups of gas-works should combine for carrying on independent tar distilleries; and more may be heard of this ere long.

It was quite early in the year that the War Office placed restrictions upon the sale of benzol; and from this point started the developments for increasing the supply of toluol beyond that available from the production of tar in the United Kingdom. Dr. Harold G. Colman, in his advisory capacity in this matter, published descriptions of methods for determining the amount of toluene in tar; and then came the discussion, at first largely *sub rosa*, as to the preferable methods for washing gas in order to secure a larger supply of both benzol and toluol. Supply was imperatively demanded. Germany had during years accumulated a large stock of the requisites for making high explosives; and Professor Vivian B. Lewes stated (and he was in a position to know) that, at the beginning of the war, there were only about 20 tons—certainly not more than 50 tons—of trinitrotoluene on the English market. It was a serious position in which this country found itself, when Germany had made high explosives a paramount essential in the war. The gas undertakings came to the aid of the country in an extremity produced entirely by past neglect; and what the gas undertakings have done is rather a striking commentary on the action of the chemical manufacturers and the Private Bill authorities in trying to reduce the mobility, efficiency, and economy of the industry in the matter of dealing in and working-up its own secondary products. First of all, there was discussion of the oil-washing processes of Dr. W. B. Davidson and the Gas Light and Coke Company. It was found in connection with the former that by prebenzolizing the wash oil—using about 5 per cent. of 90 per cent. benzol—the effects on the illuminating and calorific power of the gas were negligible, though nearly 80 per cent. of the toluol was removed from the gas. This has been proved true time after time in the experimental work that has been carried out. With the Gas Light Company's process, it was found that, by careful selection of the wash oil, and proportioning the quantity of oil to the volume of gas to be treated, there was (without prebenzolizing) very little injury done to the gas. But these oil-washing processes mean special plant. Then came the "C" process, which any properly equipped gas-works, with a spare scrubber and pump, can adopt. The process is not so efficient quantitatively as the oil process; but its charm, under the circumstances, is that it can be readily adopted by gas-works, without much cost, and be at once put to work, and so make immediate contribution to what was, and is still, urgently required. The experience with the system has been an education. It has been found that the benzol content of gas from English coals of comparable quality increases as they go South—that is to say, the highest content is found in Shropshire and Derbyshire and some South Yorkshire coals. The yield of toluol per ton of tar, using the "C" process, of course varies not only with different coals but with methods and temperatures of carbonization, and the amount of supervision that is given to the working of the process. More might be done in improving yield by many works operating the process, though no gas undertaking can hope to reach the 7 gallons of toluol per ton of tar that was found in one consignment from the Valley Road works of the Bradford Corporation. This was extraordinary; but more ordinary figures are from (say) 2·5 gallons up to a gallon or so higher. Various other proposals were made and discussed in our columns for increasing the yield of toluol—lower temperature carbonization and the use of limestone as a catalyst being among them.

Gas undertakings were asked to operate for maximum yield; and more works were required to take up the process. A great number of the smaller undertakings did not immediately respond; but more and more, in a position to do so, are coming into line. In the autumn there were about 600 gas-works operating the process; and still the cry was for "toluol, more toluol." Many of the undertakings took up

the work quite patriotically; others hung back—we hope only because they did not thoroughly understand the position, and not because they were not assured as to whether there was profit in it for them, or because they did not wish even in this respect to be put out of their ordinary routine. But the country's interests in this war are supreme; and circular-letters were issued early this winter requiring, under the powers conferred by the Defence of the Realm Act and the Ministry of Munitions Act, the recipient gas undertakings to wash their gas to extract the benzol, toluol, xylol, and other constituents. At the same time, gas undertakings were relieved of forfeiture for any lapses from the obligations as to illuminating power or calorific value. Local authorities were asked to do everything possible to protect gas undertakings from attacks in the event of their gas exhibiting any deterioration in view of what they were doing in the national interests. Some local authorities showed their "appreciation" of the meaning of this by talking of the communications in public; and the Bristol Sanitary Committee topped the request of the Ministry of Munitions by publicly talking of some *quid pro quo* for the consumers in respect of any infringement of statutory quality. So much for the appreciation by these people of the situation and of the inviolable priority of national obligations and duty. This publication also started some mild agitation among small bodies of consumers for reductions of gas prices—all due to a misunderstanding of the position.

In connection with the High Explosives Department, Mr. W. Doig Gibb has been retained to act as technical adviser at headquarters. Quite a number of gas engineers, too, have given their services voluntarily in the position of District Inspectors in order to keep an eye on the operation of the recovery process, and to assist in the development of supplies. There has been excellent keenness shown in this matter.

One trouble arising from the working of the "C" process which the setting-in of cold weather accentuated was that of naphthalene deposits. The process has the effect—providing the temperature is right, and the tar is not supersaturated with naphthalene—of reducing the number of grains of naphthalene per 100 cubic feet of gas; but, owing to the amount of light oils extracted from, and thus the change in the constitution of, the gas, with the coming of cold weather some difficulty arose. Other causes may have contributed to the trouble, as discussed in an article by Mr. Thomas Glover in our columns a fortnight since, when he also suggested remedies for the trouble—such as the introduction of vaporized oil to the gas, or washing the gas with water gas tar to reduce the naphthalene.

Another difficulty was with some of the tar distillers, who did not evince any great alacrity in giving gas undertakings full credit for the greater value of the tar sent to them from works operating the "C" process, but not a tar dehydration plant. This was a matter that was fully dealt with in an article, headed "The Market Value of Light Oils and Other Constituents of Tar," which appeared in the "JOURNAL" for July 20.

Interest was aroused in an announcement from America that Dr. Walter F. Rittmann, the Chemical Engineer to the United States Bureau of Mines, had invented a process for the production from crude petroleum of supplies of material for making dye-stuffs and explosives. There is nothing new in recovering the essentials for dye-stuffs and explosives from petroleum; but Dr. Rittmann claims to have exceeded anything that has been done before. Interest is whetted; and further information is awaited.

With regard to the applications of tar, the President of the Iron and Steel Institute, the late Dr. Adolphe Greiner, presented a note at the annual meeting upon the heating by tar of an open-hearth furnace. Using a 12-ton furnace, so good were the results (as reproduced in the "JOURNAL") that at the Cockerill works at Seraing, Belgium, a new 25-ton furnace was built, furnished with appliances for the exclusive utilization of tar as the fuel.

THE SUPPLY OF DYE-STUFFS.

While on the subject of tar, the question of the supply of aniline dyes and colours may be referred to. Preceding the war, the aniline dyes annually used in Great Britain were valued at approximately 2 millions sterling, of which less than 15 per cent. were produced in this country. Soon after the war started, it was realized that important industries of this country would be crippled for want of dyes and colours unless immediate steps were taken to supply them. Germany had been the country that had governed in this manufacture and trade, and upon that country we had largely relied for supplies. However, Germany was put out of the field as a supplier; and the British industries concerned, led by the Government, turned attention to see what could be done in the way of providing requirements by developing home resources. Some of the larger gas undertakings immediately entered into the work of helping to rescue the country from a disastrous position by putting down plant for obtaining intermediate products.

Then came the great dye scheme, promoted by the Board of Trade, in which the Government are largely financially interested, and for which they are finding £100,000, spread over ten years, for research. The idea was that the greater part of the capital should be found by the users of the dyes, and that the Government should for the time being supply a definite proportion. The details are to be found in the year's volumes of the "JOURNAL." But a strange thing about the scheme is that it was all but wrecked by the very people for whose benefit it was primarily proposed, and whose businesses would have gone to the wall had a scheme for the development of home production not been matured. It looked at one time very much as though the scheme would fail; but thanks to the persistence of the Board of Trade and those who had worked with them in the matter, British Dyes, Limited—being a modification of the original project—was launched. Before this, however, there was talk of free trade and protection; and these old political fetishes were held up and worshipped, as though this was not an occasion when the need for the country helping itself was superior to any political principles. But there is no necessity to traverse the old ground again about which hopes and fears were plentifully strewn. Suffice it, the scheme is in actual existence, and is being developed on systematic lines. In connection with it, Dr. W. B. Davidson, late of the Birmingham Corporation Gas Works, has been appointed Chemical Engineer. The works of Messrs. Read Holliday and Son, at Huddersfield, were purchased by the Company; by July their capacity had been nearly doubled; and developments are still proceeding. Good relations, too, have been established with the Swiss producers. The research department was (according to the latest information) being founded; and Dr. G. T. Morgan, F.R.S., of the Royal College of Science of Ireland, has been invited to become head of the department. An Advisory Committee has also been constituted. Thus the country was in this respect well before the end of the year in a happier position than it was in at the beginning of the year. The technical and business men at the head of affairs ought to secure the country in respect of dyes and colours; and between the Company and the loyalty and co-operation of users, Germany should find itself, when peace is declared, no longer wanted for a very large part of the dye and colour business. Meantime, America is also extending its productive capacity; so that Germany will not in this regard be in such big request after the war as before it.

SULPHATE OF AMMONIA AND NITRATE OF SODA.

Through the street and shop lighting restrictions, and domestic economy, although in industrial areas the consumption of gas rose considerably for munition work, there is little doubt that, taking the country through, the amount of coal carbonized by gas-works (during part of the year a larger amount of water gas was produced in many cases) has been diminished; and so the quantity of residual products has likewise suffered diminution. In the fore part of the year, Messrs. Bradbury and Hirsch estimated a fairly considerable falling-off during 1914 (including five months war) in the quantity of sulphate of ammonia produced; and when the report of the Chief Inspector under the Alkali Works Regulation Act (Mr. W. S. Curphey) appeared, it was seen that the returns at his disposal placed the reduction by gas-works for the year at about 5000 tons. The position of this product has been, and is, an interesting one. It is a secondary product that depends largely upon overseas trade; and it is a product that is commercially threatened more than any other. Unless steps are taken to establish British interests in it firmly in the foreign markets while Germany is out of competition, we may, when peace again reigns, see our production suffering a heavy set-back. Never was an Association more needed than is the Sulphate of Ammonia Association to-day; and some sound advice has

been distributed by them, by circulars and through papers at the different Association meetings, as to what makers must do if they are to meet the German competition. It is easy enough to-day to say: "All is well." The point is, Will all be well after the war if proper steps to protect British sulphate of ammonia are not taken with the universal support of the makers?

The position is this: Germany's production of sulphate of ammonia was prior to the war increasing by leaps and bounds from gas-works, coke-ovens, and through the synthetic process; and the German Sulphate of Ammonia Association were developing the markets abroad by very systematic and telling ways. The chief method was a guaranteed 25 per cent. ammonia product, and selling at a lower price than British 24½ per cent. ammonia sulphate! The British production was, well before the war, already seriously feeling the competition; and it had been practically driven out of the Continental markets. What was happening was the *raison d'être* for a strong Sulphate of Ammonia Association here. Methodically, the Association has been at work. But some producers do not seem to take the competition of Germany seriously; and the Association find themselves faced with the difficulty of converting the unbelievers. They should mark well the statement in the report of the German Sulphate of Ammonia Association, that, "notwithstanding the interruption produced by war complications, the Association have resolved to maintain the activity of its foreign offices so far as possible, in order to extend and strengthen the possibilities of sales after the conclusion of peace." The 25 per cent. ammonia quality is now asked for abroad; and among the advice of the British Sulphate of Ammonia Association is that all our home makers should produce what is wanted abroad, and that is the 25 per cent. quality, and containing not more than 3 per cent. of moisture and ½ per cent. of free acid. Against this prescription short-sightedness has been showing hostility, as though the sole arbiters in the matter are the British makers, and that buyers have no say in it, nor the competitors of Great Britain for the trade. Then there is, in addition to synthetic ammonia, and (in normal times) increasing production from gas-works and coke-ovens, the production of cyanamide or Norwegian nitrate of lime. The nitrate of soda importers also see reason for being more than ever on the alert. Although the Nitrogen Products and Carbide Company have so far disappointed the shareholders, we had the Société Norvegienne de l'Azote reporting gross profits of £468,000 for 1913-14, compared with £442,000 in 1912-1913, and net profits of £316,000 and £287,000 in the two years respectively. This does not look like phantom competition. However, the German competitors in the foreign markets have set the pace; and so this country has to counteract it. In order to keep abreast of them after the war, our Sulphate of Ammonia Association will want its intelligence and selling systems well organized.

Regarding home trade, the advice has been given that the services of the corn factor should be developed in doing business. There again, though the corn factor is a person of influence with the farmer (to whom the Board of Agriculture have appealed to increase the production of his land, which ought to benefit all fertilizers), there are some sulphate of ammonia makers who begrudge him a fair profit on the business he does, and so turn his interest in favour of other fertilizers. The Association also propose a method for avoiding violent fluctuations in the price of sulphate of ammonia, which are an abomination in the eyes of the agricultural merchants. Firmer prices can only be realized by producers refraining from spoiling each other's markets by competing and underselling, and by giving longer tenure to prices. The proposal is for prices to be fixed monthly in given districts by a local committee of producers for 24½ per cent. and 25 per cent. ammonia. Expediency and not political principles must govern in a case such as this. The sulphate of ammonia makers cannot afford to neglect any opportunity for consolidating their commercial position; if they do neglect their opportunities, they will regret it. It may be added here that in connection with the war, the Association entered into an agreement with the Board of Agriculture as to the reservation of a quantity of ammonia for home use, and as to the price to be charged for it.

Regarding the prices of sulphate of ammonia, the average figure in 1914 was £11 7s. 1d. per ton, which was less by £2 0s. 5½d. than in 1913. But in December, 1914, the price was upward bound, and reached over £12 per ton. This year has seen prices by easy gradations pass from about £12 to the neighbourhood of £17, with only small reversions from the upward course. One would have to go back a long way to find business at such prices. The report came from Germany that early in the year £13 10s. per ton was being obtained in the Elbe District for 25 per cent. ammonia quality, and £13 15s. for 25½ per cent.; while east of the Elbe about 5s. per ton above these prices was being paid. Legislation was proposed in Germany to create a nitrogen monopoly there.

In his annual report, under the Alkali Works Regulation Act, Mr. Curphey stated that he and his staff found a distinct tendency to a higher standard of working in connection with sulphate of ammonia production—partly through the economy and larger yields effected by the preservation of ammonia in dealing with the storage of liquor, partly owing to the adoption of improved plant, and partly to closer attention to details generally. The report also called attention to the incipient adoption of the direct process of recovery on gas-works; and with such adoption Mr. Curphey anticipates higher yields per ton of coal. He also counsels the application of more scientific control to this work. Within the past few weeks, Mr. Curphey has added to the indebtedness of the industry to him by publishing the results of some trials made as to the preservation of ammonia by having a thin film of suitable oil on top of stored liquor. The saving is remarkable [see "JOURNAL," Nov. 23, pp. 419, 424.]

Among associated miscellaneous matters, there was difficulty with supplies of sulphuric acid; a scarcity having arisen through the extraordinarily large amounts that were being used in steel works, wire works, and explosives manufacture, &c. Prices went up; and the quality of acid available to some makers did not assist them in producing sulphate of good colour. Attention was now and again directed to the question of the production of liquid ammonia. Not much was heard of the beet-growing experiments in this country; but such news as came to hand was satisfactory. Professor Bottomley, of the University of London, introduced to the notice of the British Association a new fertilizer, produced by the treatment of peat with bacteria. The result is said to be about fifty times more valuable than farmyard manure. During the year, there was issued the final report of the Royal Commissioners appointed to inquire into the methods of treating and disposing of sewage; and in part it dealt with the question of the discharge into sewers and streams of spent liquor from gas-works. The Commissioners, did not appear to possess any very definite knowledge on the subject of the purification of spent liquor.

There has been a distinct drop in the importation of nitrate of soda during the year; so much so that the position has created some alarm in the House of Commons, and has given rise to questions there. The Parliamentary Secretary to the Board of Agriculture in November stated that there would be a considerable shortage, unless steps were taken to supplement the supply. Then the total amount of nitrate of soda in this country or on its way was only about 30,000 tons, while the ordinary consumption per annum was reckoned at about 120,000 tons, of which it had been estimated that about two-thirds or rather more are used for fertilizing purposes. There is no evidence that the consumption has shown any material increase during the past ten years. Prices have moved up in the course of the year from 10s. 2d. per cwt. for ordinary quality and 10s. 6d. for refined to about 14s. 10d. to 15s. 10d. respectively.

GAS TRADING AND OTHER EXPERIENCES.

Thus we see that with coal, its conveyance, and the secondary products of its carbonization, the old conditions have given place to new—some of them of only temporary character; others, we trust, of permanent order. The industry has in short been working with an altogether fresh environment; and it has faced the situation well, and evinced anew its great vitality. Searching high or low, one could not find a better or more concise statement of the position for gas undertakings than Sir Corbet Woodall, D.Sc., gave at the meeting, in February, of the proprietors of the Gas Light and Coke Company: "There is nothing," he said "in the situation to shake our confidence in gas and in the Company. I say—not as a matter of peroration, but in sober truth, capable of proof by facts and figures—that while our difficulties and disappointments are temporary and

accidental, our financial and commercial strength and stability are permanent, and have been husbanded, developed, and extended for years past, so that we are thoroughly well found and equipped for weathering the storm that assails us, from so many different quarters at once." These words apply, practically speaking, to the whole industry; and the proof of their truth is found in the conditions at the end of the year. And this notwithstanding the bad business principles and conditions, external to the industry itself, which weighed heavily upon its fortunes, and in which conditions the Government had concern, as portrayed by Mr. Charles Carpenter at one of the meetings of the South Metropolitan Company during the year. The administrative ability of the industry, and its technical talent and executive capacity, were put to the strongest of tests, unprecedented in their many phases; and in no respect was the one or the other found wanting. Coal and oil deliveries, prices, conveyance, and the markets for residual products, gave (as already seen) cause for grave concern; and on the manufacturing side the bearing of each of the factors making up the strange situation had to be carefully weighed in order to ensure the best return to the undertakings—this especially where the ability to change the proportions of coal and carburetted water gas existed. The quantity of coal in store, coal prices, oil prices, and the sales conditions of coke and the other products were factors in judgment, and important ones in the matter of financial result, as will have been seen by what has preceded.

Upon the managements came not only the requirements as to the production of both benzol and toluol; but the gas-trading conditions were entirely changed, so much so that the circumstances of one concern in this respect has no relation to those of another concern. This makes general figures of no use whatever to show the conditions of the industry generally. For example, take the between 4 and 5 per cent. reduction of consumption of the Gas Light and Coke and South Metropolitan Companies, just over their borders there were in the suburbs increases in some cases, small decreases in others, while in many big industrial centres in the provinces, through the work on munitions, there were bumping consumption increases, so much so that Birmingham had twice to ask the ordinary consumers to be frugal in the use of gas during the depth of this winter, as the requirements of the factories must be met. Where there were decreases, they were, of course, due to the necessity for lighting restrictions in streets and shops, particularly in the London area and along the eastern and southern coasts, and in inland towns and places that might particularly court the attentions of the enemy in the prosecution of the Zeppelin mode of warfare. The wisdom of the precautions taken to obscure cities, towns, and smaller places within range, was proved, for Zeppelins occasionally came when conditions were favourable, and the lives of civilians were lost and property suffered destruction. The obscuring of lights in private dwellings was also insisted upon; and this, with the more rigid economy that private residents were induced to practise—through the compulsion of increasing expense, and through the need so constantly preached for national thrift in order to finance the war (the country's expenditure during this time amounting in the aggregate to the enormous sum of about five millions a day)—also caused reductions in private consumption. In connection with industry in areas in which considerable work was proceeding, it was the large demand for heating gas-furnaces, for power, and for lighting during night work, that caused such immense demand—a demand that in some instances moved about erratically between high and low figures in a manner which exercised severely the wit of many engineers to keep pace with the changes of requirement. There was also very large consumption in some areas for hospital and camp use—for cooking, heating, laundry work, and lighting. Under the circumstances, one cannot, in a retrospect, say anything specific as to consumption that will generally show the conditions of the industry in this regard. Comparison is defied by circumstance, and circumstance of an artificial character. But in connection with consumption, there was a grievance; and it was that while the Government asked so much of the gas industry in connection with keeping up supplies of gas, and providing necessaries for making explosives, and other things, they showed no reciprocity, either in the matter of facilitating the raising of capital for the industry's work, or of spending money with the industry, or (for a long time) in helping it to provision itself with raw materials. There was something very one-sided about all this; and representation was made to the Government on this head, through the Ministry of Munitions, by, jointly, the Institution of Gas Engineers, the Society of British Gas Industries, and the British Commercial Gas Association.

Another condition which bore heavily upon the financial results of trading—in addition to the price of coal and oil, the cost of carriage, the varied conditions of the markets for residual products, and of gas consumption—was labour. The industry, generally speaking, has lost a considerable number of its regular works and district hands, and members of official and clerical staffs—many of the men being skilled, and therefore difficult to part with in the interests of the concern. They joined the Army and Navy, and went off to munitions works. But the recruiting proceeded to such an extent that fears arose as to the ability to meet maximum demands in the depth of winter, although men less efficient, some of them raw to the work, were drafted in from outside. The same deficiency of men existed in the district, to an extent that made it impossible for any efforts at development to realize their full measure of result in actual business, seeing there were not the men to cope promptly with the new orders. It was necessary that, if the gas industry was to comply with its many obligations—if the safety and convenience of the community were to be assured through the gas supply, if industries making large demands upon gas-works for munition and other work were to be satisfied—the process of depletion of the industry's men would have to be stopped. The matter was frequently discussed—one occasion being the meeting of the Institution in June. The Institution made representations to the Government authorities on the subject; but for a long time there were no really satisfactory assurances. Towards the end of the year, however, gas-works service was listed among the occupations that were of cardinal importance to various other branches of trade and industry; and it was authoritatively stated that skilled men in such undertakings, if attested and classified in Section B (Army Reserve), would not be called up for actual service with the Colours unless their employers stated that their services could be spared. With regard to men applying for munitions work, the Ministry of Munitions gave an assurance in the case of men enrolled, that an opportunity would be given to employers to say whether or not the men were engaged upon essential work. The supply of badges for indispensable men to wear was also (for a long time) the subject of much discussion, and of equal disappointment through the reluctance of the War Office to do anything, or to give countenance to anything, that would be a hindrance to recruiting. Eventually, however, there was an issue of official badges to skilled men engaged upon the washing of gas for the recovery of toluol, and to the men engaged within works supplying gas in munition-producing areas. As most gas-works, other than small ones, could claim to be doing work of this character, the number of men qualified to wear badges was a fairly large one. In regard to those men who had enlisted, the generosity of the industry in the matter of wages, and assistance to dependants, of course, meant a fairly considerable additional charge upon the year, specially due to the war. The war bonus, too, to the men remaining at work also formed an item of some weight. Several undertakings had this year greater recourse to the assistance of women in clerical work, in meter reading, in burner maintenance, and in show-rooms.

The greatly increased costs, combined with diminished income, led many undertakings in the final quarter of 1914 to raise the price of gas; and their expenses still moving upward for coal and other material and goods, with augmented outgoings in other directions, necessitated, in not a few cases, a second advance in price in the early part of the present year. Most of the undertakings, too, that had not earlier felt the need, through large reserves or other special circumstances, to supplement income by raising the price, had to take the step this year, with the result that there are few (if any) undertakings that have not made an advance. Here, again, there was no general rule, nor could there be one, as to the amount of the advance. It depended entirely upon individual circumstances. There were some municipal concerns that could well have done without increasing the price, or to a less extent than they did advance it, had they not desired to have their full "pound of flesh" in the shape of profits in aid of the rates. A better illustration of gas consumers having to bear an undue proportion of the requirements of the local exchequer, there could not be—gas prices, in this time of stress, having been actually raised in order to provide money to aid the rates for matters unidentified

with the gas service. However, speaking generally, there is not much likelihood of gas undertakings, even with the increases of prices made, showing any excess profits arising directly from the war which can be taxed in the manner proposed by the Chancellor of the Exchequer, and as has been authorized by the Finance Act. In connection with sliding-scale companies, the increase in the price of gas affected the dividend in proportion, and in some cases where increases were heavy, very substantially; and this, combined with the increase in the income-tax, gave the return on capital an unaccustomed lightness.

We have refrained on this occasion from specifically mentioning any undertaking or giving particulars, seeing that individual experiences are so unrepresentative, even approximately, of the whole. But if one undertaking should be mentioned, it is the Alliance and Dublin Consumers' Gas Company, which showed that—through the expert advice, and the work that is being done by the Consulting Engineer (Mr. William Newbigging), and the officers, under more intelligent administration—it was well on the recuperative road; so much so that the proprietors, liberally inclined, made a present of £1000 to the three new English Directors, and added for their benefit £500 a year to the sum of the Directors' fees!

On the Continent, in South America, the Cape, Australia, India, and other quarters of the globe, gas experiences have been varied. In some cases there have been increases in the consumption of gas; in others, there have been considerable reductions—indeed, the tracks of war influences are found in the published results from Continental places near at hand and places remote. The greater of the prejudicial effects are due to coal and freights, and to indifferent markets for residuals. In India and South Africa, the conditions brought about a greater use of local coal; and this was an advantage from the financial point of view. If readers want to obtain a fair indication as to what has happened abroad in connection with the gas industry in this eventful year, they cannot do better than read the reports in our columns of the proceedings at the meetings of the Imperial Continental Gas Association, the European Gas Company, the Continental Union Gas Company, the Danish Gas Company, the Bombay and the Oriental (Calcutta) Companies, the Metropolitan of Melbourne and the Australian (Sydney) Gas Companies, the Cape Town Gas Company and the South African Lighting Association, the Primitiva Gas Company, and the Montevideo Gas Company.

With regard to company promotion work in the gas industry, the United Gas-Works Development Company has run its course, and is in the hands of the Liquidator. There were various attempts to sell small amounts of capital in the ineligible concerns in which the Company were interested, chiefly on account (so it was said) of shareholders who were compelled, owing to various circumstances, to part with the remarkably lucrative securities offered. Some interesting particulars were disclosed during the year as to the operations of the United Company and its founders. Its experiences at floating companies, with very grandiose names and ill-fitting capitals in relation to the size of the concerns, and with reports by "consulting gas engineers" who had never previously been heard of in this connection, ought to be a warning to others not to trespass on the good reputation of the gas industry with schemes with a marked deficiency of good point about them.

Financing the Industry.

In consequence of the heavy demands for money for the financing of the war, the gas industry, in common with other enterprises, came under the interdiction of the Treasury towards the end of January as to the issue of capital without consent. Later on the Local Government Board were linked-up with the Treasury in preventing the raising of additional loans by local authorities, and in urging them to refrain from spending any money upon anything that, for the time being, could be done without. But consent has not been withheld in the gas industry where proof could be given of necessity, in view of local war work, and the work that the industry is doing in connection with the provision of essentials for the war. So intent were the Treasury on ensuring that capital should not be issued under new Acts of Parliament, that during the session all Private Bills had a special clause inserted, prohibiting issues without sanction during the war and for a period after. The ban was also extended to the "exportation" of capital. Of course, the restriction where undertakings had not good floating balances to which they could have recourse, had an effect upon the prosecution of business-getting, through the enforced limiting of expenditure in this direction. But, as a matter of fact, there was no general desire to issue more capital than could be avoided (excepting, for instance, where bank loans existed of heavy amount, and it was good policy to partly liquidate these), seeing that—dividends having been reduced owing to advances in the price of gas, and market prices of stocks having fallen through this, and in common with all other securities—capital could not be issued except at figures, in some cases, considerably below par. There was further discussion of the question in municipal circles of suspending sinking funds; but this was not looked upon with favour by the central authorities. Dealing with this matter, the Secretary for Scotland expressed the view that it would be most regrettable to depart from the principle that the current obligations of each year should be borne by that year.

Then came the new War Loan, with its 4½ per cent. interest, redeemable at par, and with Government security; and this completely altered the standard of financing of all enterprise. Low interest-bearing stocks have not been in good favour for some time past; and they are less so now, with a 4½ per cent. redeemable Government loan and 5 per cent. Treasury bonds in the running. The Government also tried to draw the small investors to put money into the War Loan. Up to a point, they were successful; but the result was not all they had anticipated. In view of this, a campaign of economy was started at a large meeting of Trade Union leaders, who were addressed by the Premier, the Chancellor of the Exchequer, and the President of the Board of Trade. The British workman has been neglected by the Government in the matter of thrift and investment; and those who are not already thrifty want to be educated up to it, and encouraged by interest on their money equal to that which can be secured by the rich capitalist. The experiences of the co-partnership gas companies—of the South Metropolitan Company especially—show distinctly that the cultivation of thrift where it does not already exist among the working classes, and implanting in them the spirit of investment, are not matters of accomplishment in a day. The Government recognizing the need, in view of the changed circumstances, of assisting private enterprise passed a Bill to enable statutory companies to issue redeemable preference and debenture stocks—redeemable on such terms and conditions as may be specified in a resolution passed at a special meeting of the company concerned. There was further discussion in our columns, which was started in the earlier months of the war, as to gas companies obtaining relaxation of the ordinary conditions upon which capital can be issued by them—say, during the war and for a period afterwards, while financial stringency exists. Little was done; but our parliamentary record has shown that the discussion was not without some small effect this year, and promises more next.

In the Stock Market.

There is little to say special to gas stocks and shares. The Stock Exchange which was closed on July 30, 1914, re-opened on Jan. 4 this year under limitations. Then official quotations remained as at the date of closing. But official minimum prices for stocks and shares were fixed immediately afterwards, which minimum prices buyers, with the usual fidelity to personal interests, thought too high, and sellers similarly too low. Since then our stock and share table has shown the prices at which bargains have been effected, together with the prices that ruled at July 30, 1914. Prices of gas securities shrank in common with other stocks; but, at the beginning of the year, the good favour in which gas capital is held was evinced by the comparatively small percentage decline. But when, in the case of some of the sliding-scale companies, a second increase of gas prices had to be made, and this further affected dividends, there was a fairly sharp fall in some stocks. Naturally, throughout the year the varied fortunes of war have had their reflection on even the reduced business transacted. But, of course, everything has had an air of fictitiousness about it. In regard to gas stocks, the price reductions shown by transactions refer to all classes of stock and shares—ordinary, preference, and debenture. Only to the general conditions, and the temporary reductions of dividend owing to the increased price of gas, are attributable the falls in the

market values. Some half-dozen or so examples of what has happened will suffice. In the case of the Gas Light and Coke Company's ordinary stock, which on July 30 last year stood at 98-102, business was done early in the year at 87-89½; but towards the end transactions were at 71-72½. In the case of the South Metropolitan Company, with the price of their ordinary stock on July 30 last year at 111-113, business was effected early in the year at 100¼-103; but, towards the end, 78½-79½ was the price. Tottenham District Light, Heat, and Power Company's ordinary stock, on the other hand, stood up well against the prevailing conditions. With a price at 115-117 on July 30 last year, business was effected at round about 113 early in the year, and towards the end at 97½-98. Among companies operating abroad that suffered severely are the Imperial Continental Gas Association, the Continental Union Gas Company, and the Primitiva Gas Company. On July 30 last year, the stock of the Imperial Continental Gas Association stood at 150-160; early in the year, business was done at 81-84; and later in the year, at 73-78, but there has been a recovery to about 83. In the case of the Continental Union Company, 76-79 was the price on July 30 last year; transactions have recently been at as low as 38½. The Primitiva shares, which were standing at 5½-6 on July 30 last year, were parting company at $3\frac{9}{16}$-$3\frac{11}{16}$ towards the end of the year. In reference to the Imperial Continental, the chief properties being in Germany is a sufficient explanation of the fall; as to the Continental Union, their chief investment being in the Union des Gaz, the terrific high rates of freight to Italy, the price of coal, difficulties with the Milan Municipality as to the price of gas, and no dividend, account for their position; regarding the Primitiva Company, a break in trade conditions and financial chaos in Argentina preceding the war, and all the trouble as to coal, freights, and other circumstances produced by the war, explain the temporary cheerless conditions for the shareholders, and the drop in the market values of the shares. The Alliance and Dublin Consumers' Gas Company had the distinction of having an improvement in the market value of their stock upon the figures at which it stood on July 30, 1914. The Bank rate, which was fixed on Aug. 8, 1914, at 5 per cent., continued at that figure throughout the year.

British Commercial Gas Association.

Close upon the references to the trading and financial matters of the year, allusion must be made to the work of the British Commercial Gas Association. Their activities have been unceasing; for there was unanimity in the opinion that to discontinue the excellent educational and propaganda work would depreciate the value of that which had been done anterior to the war. The Executive and General Committees were right in both their judgment and resolve; and they were well backed-up by the subscribers—company and municipal gas undertakings and the Society of British Gas Industries. Moreover, war conditions notwithstanding, new subscribers came in—partly through the district recruiting campaign, partly through the conviction of the administrators of further undertakings as to the valuable work that is being done by the Association, and partly through the solid character of the example provided by the existing subscribers. The firmness of the allegiance of the old subscribers speaks eloquently as to their belief and experiences; and they know what is not known outside, something as to the many and varied channels in which the Association work—channels which are beyond the reach of the units of the industry, and can only be operated in by a co-operative and representative body. At the annual meeting of the Association, Bailie Paxton, of Glasgow, pointed to the indispensability of the work, and urged those undertakings still standing aloof to study the list of cities and towns the gas administrators of which are all satisfied that the work is essential to an industry whose future expansion will be the measure of the advantage taken of every means of producing it. At the time he was speaking, a sum of nearly £100,000 had been expended on the work of the Association. During the year, the Association have had new and fertile ground on which to work in connection with the use of gas in munition factories, in hospitals, military camps, nursing homes, and so forth. The view of the Association is that, though the use of gas in some of these directions may be temporary during the war, experience and satisfaction will have a lasting beneficial influence. Any business taken in hand in this connection should be so done that it is in itself an influential advertisement. However, the Association have entered upon a new year of work well backed by the subscribers, and with Sir Hallewell Rogers, the Chairman of the Birmingham Corporation Gas Committee, as the President.

War Damage to Gas-Works and Other Property.

Speaking generally, there has not been any large amount of destruction of gas-works property owing to the war. Concerning the bombardment of East Coast towns on Dec. 16, 1914, by certain German cruisers—which paid a cowardly nocturnal visit to unfortified towns, and made a hurried flight back when they descried certain units of the British Navy on their track—particulars as to the amount of damage caused at the Hartlepool Gas-Works were available early in the year. All the gasholders were struck and pierced by shells, causing the loss of the whole of the gas in stock, and temporarily depriving the district of its supply, Eight of the Company's employees were injured, and one subsequently died. The loss and damage were estimated at £7500. The Engineer (Mr. A. W. Branson) referring to the matter at the meeting of the Wales and Monmouthshire Institution of Gas Engineers and Managers in May, gave some interesting and instructive details of his experiences [see "Journal" for May 25, p. 451]. At the gas-works at Scarborough, which town was also the object of the attentions of the sea raiders, the result of the bombardment was that not 20s. worth of gas was lost. No damage to gas-works has been occasioned by air raids, though distributing mains, in two or three cases, have been fractured where bombs have dropped in roadways. At the meetings of the Imperial Continental Gas Association, information has been given, as far as available, as to damage to their works in the fighting areas. Other particulars as to French works will be found in the "Journal" for Sept. 14 (p. 570). The Rheims Gas-Works suffered very severely from bombardment [see "Journal" for May 25, p. 458]. One experience there bore out the various theories put forward at the commencement of hostilities as to what would happen when projectiles fell upon gasholders—namely, that when a holder runs freely upon its guide-framing, and can descend in such a way that the gas is always under pressure at the perforation, emptying is effected without inconvenience, until the holder has grounded. But the pressure in the holders could not be maintained at Hartlepool owing to the breaking of the mains running from the retort-houses. Through mines and torpedoes, several colliers conveying coal to gas-works have been sunk; and many thousands of tons of good gas coal are consequently lying at the bottom of the sea.

On the Works.

The matters already dealt with are largely of unusual interest and significance in view of the war; and thus the excuse for having devoted so much attention to them. The more ordinary affairs of the industry have been kept by the war rather severely in the background; and we will only remind of a few of the salient features. Take works and plant first, the capital restrictions, war work, as well as the extraordinary anxieties of the year, have largely put into abeyance works' extensions. But there have been in our columns a few descriptions of new works and extensions. Vertical retort installations have been prominent. This plant has also been making great headway in America. In other parts of the world, too, it continues to obtain increased adoption. At Cape Town, it has been found that verticals are especially suitable for carbonizing inferior local coals. Horizontal retort working, owing to further improvements in machinery for dealing with heavy charges, has also gained in position during the year. The De Brouwer, the Fiddes-Aldridge, and the Bancroft-Hansford retort charger (in conjunction with the Guest and Gibbons machine) have received reference in this connection. Some special articles by Mr. H. C. Widlake have been devoted to the maintenance and care of the first-named machine. Further use in Continental works of chamber ovens for gas manufacturing purposes have been described. Occasional references have appeared to low temperature carbonization. The late Professor Lewes dealt with the subject in an address to the London and Southern Junior Association; and Dr. F. M. Perkin, in a lecture, referred to the extravagant anticipations that had been put forward in this connection. We are at present waiting for more information as to the

Coalite installation at the Old Silkstone Collieries, Barnsley. Telpher plant has increased its field of operation; and Mr. R. E. Gibson has shown the economy of the crane and gantry for moving materials. Following the Windsor Street (Birmingham) installation, the Tottenham Light, Heat, and Power Company have adopted turbo-driven gas-exhausters. Speaking of this Company reminds of the description given of their gas-driven electricity station for the supply of Wood Green. A German invention has been described for the construction of gasholders without water-tanks. Nothing new has transpired in association with water-gas manufacture; but methods of operation have occasionally been discussed in papers—especially from America. Early in January, there was published the full text of the paper by Mr. E. V. Evans, before the Society of Chemical Industry, on the removal by heat of carbon bisulphide from coal gas, as practised at the works of the South Metropolitan Gas Company. Several instances of the application of reinforced concrete in gas-works have been described. An interesting engineering contribution was that recounting the flooding and the work of restoration of the Astoria Tunnel, New York. A series of articles was published by us early in the year on the use of electricity plant on gas-works; and hints were given as to the realization from them of the most effective working.

In regard to methods, the recognition grows of the need for attaining on economic grounds the maximum efficiency on gas-works. Allusion has been made to this earlier in the retrospect in connection with residual products. There has also been insistence on the need for constant control in processes in which heat is concerned. At a German gas-works, experiments showed the economy to be derived from making use of the heat that goes to waste on gas-works. With regard to retort material, the Refractory Materials Committee presented a very short report this year at the Institution meeting; and it was seen that slight modifications have been made by the Committee in certain of their conclusions. The deterioration of retort material by salty coals has received further consideration. The importance of the thermal conductivity of refractory materials has been accentuated by an investigation by Professor J. W. Cobb and Messrs. Dougill and Hodsman. Discussed, too, by Professor Cobb and Mr. Harold Hollings has been the subject of heat exchanges in carbonization, which seems to be a matter that may have a very direct bearing on the determination of the best practical carbonizing conditions for different gas coals.

Bye-Product Coke-Ovens.

A great deal has been written during the year on the coke-oven industry. Several papers referring thereto have appeared in our columns, as well as a number of notes by "Event and Comment." There are four outstanding features this year relating to the coking industry. The first is the successful formation of the Coke-Oven Managers' Association, at the inaugural meeting of which the first President, Mr. George Chrisp, delivered an interesting address on the progress of the bye-product industry. The second is that Leeds is now purchasing about 1 million cubic feet per day of coke-oven gas for general supply, following the example of Middlesbrough. The third is that the Yorkshire Power Company are now utilizing coke-oven gas for boiler firing at one of their stations for generating electricity. The fourth is that there has been a considerable amount of criticism of the want of scientific control in connection with bye-product coke plants, and the beehive oven has received further condemnation for its extreme wastefulness.

Distribution and Meters.

There has been little to particularly attract notice in connection with distribution. Sundry papers and articles have appeared on the subject; and incidentally there has been some further good testimony regarding the value of the lead wool joint. A useful compilation as to the cost of the reinstatement of pipe trenches in the area of the Metropolitan Water Board was published in our issue for June 29 (p. 768); and we have had Mr. Reginald Brown putting forward a plea for a better understanding between road authorities and those who have to open roads in connection with their distribution systems.

As to meters, an Association of Official Inspectors of Gas-Meters has been formed, with the object of procuring, as far as possible, uniformity of practice in the administration of the Sales of Gas Act. With regard to high-pressure meters, it was suggested, in the annual report of the Manchester City Justices Committee, that, should the high-pressure meter powers obtained by the London County Council and the City Corporation prove satisfactory, the Board of Trade should take steps to apply them generally. A description of the "B.T.H." steam-flow meters appeared during the year. In connection with prepayment meters, more frequent collections have been urged, in view of the shortage of copper.

Lighting, Heating, and Power.

Generally speaking, there is not much to be said under this heading. The war has had effect upon topics and improvements that would in ordinary course call for notice. But the year showed that, in every way, we are satisfactorily tending towards greater scientific accuracy in both production and application. The Joint Committee on Ventilation of the Institution of Gas Engineers and the Leeds University (of which Committee Professor Arthur Smithells is the Chairman) have been going about their work in a methodical manner; and an instructive report was presented by the Research Chemist (Mr. William Harrison, M.Sc.) at the meeting of the Institution. In other ways, a great deal of attention has been paid to this subject in association with the application of gas; and architects, there are indications, are becoming better informed as to the applications of gas, and how particularly gas heating can help them in structural design, by the use of small flues for gas-fires, and by promoting convenience in the kitchen by, when erecting new houses, the immediate introduction of a gas-cooker, gas-heated circulating water-boiler, and a gas-fire. Mr. W. L. Westbrook showed, in a recent paper read before the London and Southern District Junior Gas Association, that practical experience proves there is economy in this, as well as convenience, for householders. Among other general topics, a translation of a lecture on the hygiene of gas, by Dr. M. von Gruber, has been published by us; and the doctor has been subject to some well-deserved criticism by Mr. W. J. A. Butterfield.

An event of the year has been the issue of the Departmental Committee's report on the lighting of factories and workshops. By it the importance of good illumination was shown in respect of the improving of works' output, the prevention of accidents, and the protection of the eyesight of workers. Some recommendations as to minimum foot-candle illuminations were made by the Committee. At a meeting of the Illuminating Engineering Society, it was urged that the Departmental Committee should go further in the matter of the relation of illumination to eyesight. The more there is discussion, the greater are seen to be the difficulties of prescribing, except in a very general way, standard illumination for all sorts and conditions of factories and occupations. In connection with high-pressure lighting, Mr. A. E. Broadberry gave, at the spring meeting of the Eastern Counties Association, a description of excellent examples of factory lighting by means of high-pressure gas. Some illustrations of the splendid effects obtained with this system have also come from the Panama-Pacific Exposition, the Dunfermline station of the North British Railway, and from the suburbs of Melbourne.

As to mantles, we are now assured, largely through the agitation initiated in our columns, of a supply of thorium nitrate, without having to rely upon Germany; trading in the Travancore sands having lately been put under proper control. On the question of mantle trading, there has been evidence—the matter was discussed on a paper by Mr. R. J. Milbourne, at the last meeting of the Society of British Gas Industries—that German mantles have found their way to the British markets through neutral countries, and under various disguises; and letters in our "Correspondence" columns indicate that the traffic has been very considerable. The steps taken by the Government to exercise better control over imported goods may have the effect of countering Teutonic artifices in this direction.

There has been little new in the gas-cooker line. Miss Edden is responsible for the design of a new externally heated oven for domestic purposes. The economy and output of large biscuit factories have been raised by the production of the Baker-Keith-Blackman gas-heated oven, the virtues of which have been described in our columns.

In connection with gas-fires, as well as other gas-consuming appliances, there is continued general movement towards still higher efficiencies. May this proceed; for upon economy and efficiency the trading progress of the industry depends. In the matter of gas-fires, it is clear from a lecture delivered by Mr. Harold Hartley, M.Sc., that thermal, hygienic, and ventilating efficiencies require study and treatment in combination and not separately. For the testing of the radiant efficiency of fires, the R. S. Smith water-flow radiometer and the Ruebens thermopile have been the subjects of further condemnation. Early in the year came the new Richmond radiometer; and later the bolometric method for the measurement of radiant heat, for which Dr. W. A. Bone, F.R.S., Professor W. L. Callendar, F.R.S., and Mr. H. James Yates are jointly responsible. The movement, initiated by Messrs. John Wright and Co. with their "Injector-Ventilating" arrangement, for increasing the ventilating capacity of gas-fires has continued; and new designs, directed to securing ventilation supplementary to the flue, were brought out at the commencement of the present heating season by the Richmond Gas Stove and Meter Company and the Davis Gas-Stove Company. Silent burners for gas-fires have received further improvement; and it is seen that in the modern types of fires, the position which Mr. Yates took up some time since, as to the high canopy, has been fully vindicated by practice. This was a matter incidentally raised in connection with the controversy that arose in 1912 over his statement: "A fire that carries off all its products without being attached to a flue will, when an ordinary chimney draught comes into play, inevitably carry off more than the products—to wit, an unnecessary number of heat units as well, and a lowered room-heating efficiency is the result." Among the new fires introduced were a semi-circular fronted one, and a circular fire, the appearance of which led to discussion regarding the better distribution of radiant heat.

There has been a great boom in the use of gas-furnaces in industrial works, more especially for the rapid and uniform production of munitions of war. In consequence, all the firms who specialize in gas-furnace work have been particularly busy. Mr. H. M. Thornton read a paper on the use of gas-furnaces in war time and always, at the Royal Society of Arts; the Brayshaw furnaces were put on exhibition in Sheffield; and altogether there has been a great deal of life in this direction, which will have permanent advantage. The furnaces that have been installed this year represent an immense aggregate consumption of gas. A couple of highly informative papers on the treatment of iron and steel by gas heating have been published by Professor A. H. White and Mr. Homer T. Hood. They will be found in the "JOURNAL" for Oct. 19 and Nov. 9.

As to the use of gas for power purposes, there are distinct signs of a retracing of steps by manufacturers from suction-gas to the less troublesome and more convenient town gas, where prices are suitable; and, with the greater attention now given to the regulation of engines, and the adoption of more modern ones, efficiency and economy are proving obstacles to the electric motor. Mr. Widlake mentioned an interesting case where an old 6 B.H.P. gas-engine displaced an electric motor of equal horse power in a laundry—the engine working efficiently two hydro-extractors, where the electric motor could only inefficiently work one.

TECHNICAL AND OTHER BODIES.

The war has had a tremendous influence on the work of technical organizations; and the character of their proceedings has been considerably altered. The Council of the Institution of Gas Engineers abandoned the proposed meeting at Southport, and instead had a short morning sitting in London, without papers. But there was a brief address by the President (Mr. John Bond), who the Council invited to continue in the presidency another year; but work at Southport and for the Ministry of Munitions prevented him acceding to their wishes. Before retiring from the chair, Mr. Bond subscribed 100 guineas to the Institution Building Fund. Mr. John Young has succeeded Mr. Bond in the presidency. Although the annual meeting was short, it was an interesting one—made so by the President's address, the reports presented, and the discussions. As will already have been seen, the President and Council have been very busy during the year in dealing with the different adverse influences (arising from the war) upon the affairs of the industry. Coal supplies, tar prices, railway traffic, sea transport, recruiting, medals for workers, and industrial finance were subjects that frequently claimed their attention and action. Some of the District Associations held full meetings; others did not. The junior organizations met and also engaged in visits, with the exception (this winter) of the Manchester organization; but in some cases the programmes for the present session have been shortened. No signs of diminishing vitality are shown by the junior organizations. Reference has already been made to the work of the British Commercial Gas Association. The Society of British Gas Industries have held meetings, under the chairmanship of Mr. Alderman F. Templer Depree. In his address at the March meeting, he proved that the existence of the Society had been fully justified. The San Francisco Gas Congress, in association with the Panama-Pacific Exposition, was a great success. The President of the Congress was Dr. A. C. Humphreys; and the President of the American Gas Institute (also in session on the same occasion) was Mr. E. C. Jones. Their respective addresses evinced an unshaken belief in the future of the gas industry. The German and Austro-Hungarian Associations both held brief meetings this year. The Société du Gaz abandoned their meeting, as did also the Italian Gas and Water Association; but the Dutch and Norwegian Associations held theirs.

The Illuminating Engineering Society have also met, and contributed some interesting matters to questions of special interest in connection with illumination. But, of course, in this case as in others, the character of the work has suffered somewhat through the war monopolizing so many men, and all people's minds. In this connection, it may be mentioned that the street-lighting specification has not yet assumed definite shape; but certain modifications have been introduced, providing for the inclusion of maximum as well as minimum horizontal plane illumination (the one being within definite limits of ratio to the other), and for some specified control as to the height of all lamp columns. The work of the International Illumination Commission has been interrupted; but the various National Committees have been proceeding on independent lines. Our own Committee have elected Mr. W. Duddell, F.R.S., as Chairman in place of the late Mr. Edward Allen, and Mr. John Bond has been appointed a Vice-Chairman. Mr. Jacques Abady has been elected a member of the Committee. A translation, by Mr. W. J. A. Butterfield, of a study by Dr. E. Ott, on the dependence of the light of the Hefner lamp upon atmospheric conditions, more especially atmospheric pressure, has had extensive publication. There are indications of a closer alliance of the Chemical Societies with the industrial organizations; and the presidency of the Society of Chemical Industry by Mr. Charles Carpenter, D.Sc., should have influence in this direction.

The Gas Companies' Protection Association continued their excellent work, particularly assisting in the actions which helped the electricity supply industry to appreciate its legal position in the matter of powers of charge. Mr. H. E. Jones, the Chairman of the Council of the Association, has again urged the larger co-operation of the smaller gas undertakings; and a feature of his address at the annual meeting was his censure of the coalowners in the matter of interpreting of the Coal Prices Limitation Act.

PROFESSIONAL TOPICS.

One unpleasant feature of the year has been the attitude of the members of certain municipal bodies towards the gas profession; and it has been the duty of the "JOURNAL" to speak somewhat plainly in defence of the profession, and its rights and status. What happened at Huddersfield, Blackburn, Neath, and Stoke-on-Trent will be well within the memory of readers; but the occurrences have not appreciated, but have had a distinctly bad effect upon, municipal service in the eyes of the members of the profession. In regard to Stoke-on-Trent, the Gas Committee there have carried the day against those who stupidly sought to reduce the office of gas engineer and manager to a level that would have excluded from application for the position men of talent and ability. In this connection, Mr. James Macleod raised the question, in an article in our columns, as to what the Institution of Gas Engineers had done to protect the members of the profession in municipal service against the opprobrium and degradation to which a section of local councillors subject them in a few places. The answer was that the Institution has done nothing; and Mr. Macleod's article received widespread approbation. Criticism has

also had to be made about the revival of the circular-inquiry nuisance, especially in connection with circulars emanating from Stoke-on-Trent and Slough regarding professional salaries. Other circulars that came in for condemnation —issued from Huddersfield and Margate—referred to public lighting questions. We think this trouble is again quashed—at any rate, for the time being.

Education and Examination.

There is not much to be said this year on educational matters in connection with the industry, owing to (as Professor John W. Cobb said in his annual report as Livesey Professor at the Leeds University) the loyalty of the students taking them to the front or to munitions work. But the department over which Professor Cobb so ably presides has not ceased work—investigations, with the limited assistance available, proceeding the same as far as is possible. After the war, there will be a larger requirement for trained investigators in connection with the industries; and so, at all the Universities and technical colleges and schools, there is bound to be a great revival of activity. An illustrated description that has appeared in our columns shows how thoroughly Professor W. A. Bone has organized the Fuel Laboratories of the Chemical and Technological Department of the Imperial College of Science and Technology. The Institution of Gas Engineers have established at the Leeds University, a scholarship, bearing the name of Sir Corbet Woodall, of the annual value of £50—this having been made possible through Sir Corbet's personal generosity.

The number of candidates presenting themselves this year for examination in "Gas Engineering" and "Gas Supply" was naturally greatly reduced; and the respective Examiners—Mr. Samuel Glover and Mr. Walter Hole—have had to comment on the deficiencies of the candidates. This indicates a need for a more definite scheme of training being drawn up for gas-engineering students—a matter that was raised by Mr. F. J. Bywater some time ago, and since revived by Mr. David Fulton. Mr. James Macleod in our columns last week called attention to the scheme drawn up by the Manchester School of Technology. Mr. Thomas Glover has stated his opinion that the intrinsic value of the City and Guilds examinations and the certificates would be greatly enhanced if all candidates were compelled to pass a preliminary examination in chemistry and mechanical engineering. The first gas-fitters' examination has shown the Examiners (Mr. Henry Kendrick and Mr. Ralph Halkett) the weaknesses in the training of the candidates; and their comments on the subject will no doubt have good effect in the direction of improvement.

Gas Legislation.

The session of Parliament this year saw one of the smallest crops of Gas Bills and Provisional Orders on record; but next session will beat its predecessor in respect to numerical leanness, though the quality promises to be somewhat better. The points of the session's work to be noticed are not numerous. In connection with the model residuals clause, it was noted with pleasure that some Committees justly allowed Bills to go through without the one-third restriction. With few exceptions, promoters now ask for the calorific standard and test as a matter of course. But the session saw promoters suggesting a level standard of 500 B.Th.U. (total heat value), instead of 540 B.Th.U., with 7½ per cent. margin. The Board of Trade saw no objection to the severance from the standard of the marginal limb; and Select Committees, as also the Unopposed Bills Committee, were guided by the Board. Capital questions also had prominence. Though the inhibition of the Treasury as to capital-raising has, from the first, been present in the mind of the administration of every gas undertaking in the country, the Treasury seemed afraid lest the possessors of Acts passed during the session should take it that the new capital powers granted by Parliament subsequent to the Treasury notification opened to them the door to fresh issues without sanction. They therefore had a clause inserted in Bills specially prohibiting promoters, for a period, from issuing any part of the capital without their permission.

The capital position of gas undertakings in war time was brought before Committees. Hard times have come, and they will be sterner yet, in respect of capital-raising. With the reduced dividends that are being paid by some sliding-scale companies, stock has had to be sold much under par. The new 4½ per cent. war loan has also set a new standard upon the earning power of money. It is therefore only right that those in charge of gas undertakings should see what, if anything, can be done to get relief from statutory conditions which, under the present exceptional circumstances, are obstructive to the securing of any capital on the best possible basis. The Ascot District Gas and Electricity Company sought relief from the auction clauses for the space of years directly affected by the war. This was refused; but the same Committee gave the Company permission to make greater use of their credit by raising the borrowing powers to one-half proportion, in place of the customary one-third. In the Northwich Gas Bill, the Company (it is a maximum price Company) obtained capital conversion powers on a 6 per cent. basis, as their advisers felt that a 5 per cent. basis would not be much good. A useful Act will be the Statutory Companies (Redeemable Stock) Act; and this should not be overlooked. Then the Local Government Board were anxious to get more uniformity in the loan-repayment periods granted in municipal Bills, with a reduction of the periods. They tried this session to persuade Committees to leave the decision of the periods in their hands. Committees, however, did not see fit to relinquish their duties in this respect; and divergent results obtained, instances of which were given in an editorial article in the "Journal" for Aug. 17.

The Chelmsford, Lurgan, and Skegness Purchase Bills passed. The Northwich Company resigned their new works' proposals in view of the opposition shown, and consented to remain a maximum price Company. A purchase clause, after the lines of the Chelmsford one of the preceding session, was agreed to between the Company and the local authority. The large schemes of electricity concentration for London were withdrawn, as the Government were not disposed to have time absorbed by contentious matters of such magnitude while the war continued. The Yorkshire Power Company, who wanted roving lighting powers, were sent home to attend to business on the lines of the powers already possessed, and were informed that Parliament were not prepared to grant them preferential rights. The Spennymoor and Tudhoe Gas Company were given the right to hire-out dynamos in conjunction with gas-engines. The Plymouth Corporation had their gas-fittings and hiring powers confirmed in respect of Devonport; and electrical powers on the same lines, existing as they did in Devonport, were granted by a Lords Committee in relation to the whole of Plymouth. But threatened further opposition by the local contractors in the lower House led to an agreement for the application of the model clause, with its limitation of liberty in connection with wiring and dealing in electrical fittings. The Northumberland clause was obtained in respect of an extension of the electric supply area at Southampton, though, in the special circumstances, it was refused by the Board of Trade and by the first House before which the Order came for confirmation.

An event of personal importance is that Mr. Balfour Browne, K.C., who has taken part in all the prominent gas fights for many years past, has intimated his intention of retiring from practice in the Parliamentary Committee rooms. This intimation has caused sincere regret among his "learned friends" and those whose professional duties take them to the Committee rooms.

In connection with Parliamentary work, a very useful book to those promoting Bills in Parliament was published during the year—Abady's "Compilation of Gas, Electricity, and Water Legislation."

Calorific Value.

The new conditions in relation to the calorific standard for gas, as framed in the Act of the Gas Light and Coke Company in 1914, necessitated a revision of the "Notification" of the Metropolitan Gas Referees, which was published early in the year. The conditions of testing prescribed by the Referees are applied generally. Canada has taken the lead in prescribing a universal calorific standard for gas in lieu of the illuminating power one. The standard adopted is 520 B.Th.U. (total heat), without a margin. The Bureau of Standards at Washington have recommended that general gas supplies should be of 600 B.Th.U. gross, although, in cases where unenriched coal gas or bye-product oven gas is sold, they consider that 570 or even 550 B.Th.U. might be a reasonable standard. The Maryland Public Service

Commissioners have also prescribed 600 B.Th.U.; while in Kansas no natural gas is to be sent out of a heating power of less than 800 B.Th.U. The Imperial Gas Association of Japan have recommended a calorific value standard of 520 B.Th.U. gross, with a margin down to 470 B.Th.U.—providing that the average is 520 B.Th.U. on three consecutive days. As mentioned in the preceding paragraph, no gas suppliers at home think of going to Parliament now with testing clauses that do not provide for a calorific value standard in place of the illuminating power one.

Legal Matters.

Happily there has been comparatively little litigation in connection with the gas industry this year; and cases are few in which any important principle has been involved. Mostly the matters have been ones of general dispute, in which the Courts were asked to adjudicate on facts. The most important action from the general point of view was the Ilford one, in which the District Council were brought to book by the Gas Company for making terms of charge for electricity which were *ultra vires*. The Long Eaton case caused the Ilford Council to reconsider their position; and they "knuckled under," and were condemned on all the points raised, including trading in fittings, &c., for which they had no power whatever. A good digest of the points at issue, and of the result, in the Long Eaton case, was supplied by Mr. George Stevenson in a paper read before the Midland Association [see "Journal" for March 16]; while Mr. W. B. Farquhar, in his Presidential Address to the Eastern Counties Gas Managers' Association, gave a full statement of the Ilford case and proceedings.

There was an action against the Conway Corporation for money alleged to have been lost, by a firm of contractors for tanks and constructional ironwork, through their men employed on a contract at the gas-works being idle for several hours daily in consequence of fumes said to come from the retort-house. The Corporation won the case; the Court holding that there was no claim in law. A case touching upon German contracts and the war had reference to the Darwen "Munich" chamber installation. In this Messrs. Joseph Morton, Limited, claimed against Messrs. R. & J. Dempster, Limited, in respect of goods sold and delivered. In the event, the Court held that the defendants in accepting goods from the plaintiffs were under a contractual obligation to pay for them; and more especially so as the former had banked the sum of money received from the Corporation which included the price of the goods for which they were sued, and which would otherwise have been held till asked to account for it to the German Company at the close of the war. In connection with a gas-stokers' strike at Coatbridge, the Coatbridge Picture House, Limited, made a claim for loss and damage sustained by them in consequence of the failure to supply them with gas. The claim was, however, dismissed. A case in which a claim was made against the South Suburban Gas Company had reference to the recovery of damages for injury caused to a child through the overturning of a fire brazier which was being used while repairing a gas-main. In the County Court plaintiff was awarded £25. The Company appealed, and lost; Justices Avory and Lush holding that the conclusion might quite reasonably be come to that what the defendants were doing constituted, in the circumstances, a nuisance in the sense that they were doing something on, or adjacent to, a highway which was dangerous to persons lawfully using it, unless proper steps were taken to guard against accidents. The Swansea Gaslight Company succeeded on appeal in causing the Swansea Rural District Council to comply with an agreement for lighting part of their territory, out of which agreement they were trying to shuffle. A question relating to a coal contract in which the Cardiff Gas Company were concerned came before Mr. Justice Lush. The plaintiff made a claim against the Company for the value of some coal delivered; and the Company counterclaimed for £1100—the difference between the contract and the market prices for coal which had to be purchased elsewhere, owing to non-delivery by the plaintiff. The plaintiff's case was that non-delivery was due to an accident causing the partial stoppage of the colliery. His Lordship was of opinion that it would be too narrow a construction to put on the contract that, unless the whole of the works at the colliery stopped, the plaintiff was not entitled to relief.

A particularly painful case was that in which Thomas H. Lamb, the late Secretary of the Walton-on-Thames Gas Company, and George W. Ross, chief clerk, were charged with feloniously stealing certain sums of money. Lamb was eventually found "Not guilty;" while Ross (who pleaded "Guilty") is now passing through a sentence of twelve months' imprisonment, with hard labour. A collector of the Salisbury Gas Company was sentenced to six months' imprisonment for embezzlement. A settlement was made of the affairs of the Ticehurst Water and Gas Company—one of the ill-fated group of promotions by a certain City clique which claimed considerable attention some time since. Under the lighting restrictions order, the Thetford, Herne Bay, and Arlesley (Beds) Gas Companies have had to pay small fines for having too much light at their works.

Labour.

A curious and painful state of things has existed this year in large sections of the labour world. While men of all stations in life and of all occupations have gone out even willing, if need be, to make the supreme sacrifice in the defence of the honour and safety of our country, there has been a very considerable amount of unrest among labour at home—at the bottom of it all being selfishness. For this the opportunity provided by the war has been looked upon as a grand thing. Duty and patriotism have taken second place; comrades in the trenches have, action shows, been largely forgotten, and little cared for, by the malcontents at home. Thank goodness this has not been general, as witness the work in the munitions factories. Had it been general, the country would have been thrown into desperate straits, and its part in the war would have had quick and most deplorable ending for us and our successors. But the war efficiency of the country has been depreciated by the labour troubles. Reference has previously been made to the immense difficulties in the coalfields, especially in South Wales. Even ships containing food and munitions for the front were at one time held up through a strike of dockers. War bonuses have been granted in almost every industry, in view of the higher cost of living; and now a movement is afoot among the trade unions to make these payments permanent. This is one of the items in the programme of the great labour combine just brought about by the Miners' Federation, the National Union of Railwaymen, and the National Transport Workers' Union. There have been hints, too, of a further trade union movement to secure still higher standards of wages; and at the recent meeting of union leaders, at which Mr. Asquith, Mr. M'Kenna, and Mr. Runciman spoke on the subject of economy, appeal was made not to cause further embarrassment by encouraging any higher wages movement. In the gas industry, there were differences with workers, principally as to their wages, at Birkenhead, Carlisle, Cheltenham, Clonmel, Coatbridge, Limerick, Macclesfield, and Maryport, and threats of trouble were heard elsewhere. Co-partnership has shown its greatest power and advantage in these times when, owing to increases in the price of gas, most profit bonuses have been reduced. Other matters referring to labour in the gas industry are mentioned under the cross heading "Gas Trading and Other Conditions."

Personal Matters.

The list of official changes that have been made during the year is of remarkable length; and we can only notice some of the representative ones. Out of alphabetical order we should first mention the retirement, on account of ill-health, of Mr. W. Doig Gibb from the Chief Engineership of the South Metropolitan Gas Company, and the appointment of Mr. G. M. Gill (Assistant Engineer of the Commercial Gas Company) to succeed him. Mr. R. E. Gibson has succeeded to the Engineership of the Liverpool Gas Company on the death of Mr. Edward Allen; while Mr. Ernest Astbury has been appointed Assistant Engineer to the Company, and Mr. Edward Allen (son of the late Chief Engineer) has been placed in charge of the Linacre Gas-Works. Mr. Joseph Cash has retired from the Chief Engineership of the Brighton and Hove Gas Company, and is succeeded by Mr. Charles H. Rutter, with Mr. F. Smallbone as Assistant Engineer. Mr. W. J. R. Baker has resigned the Mansfield management. Mr. T. F. Canning has gone to Weymouth. Mr. Samuel Carpenter has taken up duties as Engineer and Manager at Cromer. Mr. F. Chadderton has been appointed Manager of the Barrow-in-Furness gas

and water undertaking. Mr. W. D. Child has retired from Romford, and has been appointed a member of the Board; Mr. J. C. Wright being his successor as Engineer and Manager. Dr. W. B. Davidson has left Birmingham to take up duties as Chemical Engineer to British Dyes Limited. Mr. S. W. Durkin has been appointed Engineer of the South Australian Gas Company. Mr. J. Fazakerley has resigned his position at Goole. Mr. S. E. Figgis has relinquished the Engineership of the Ballarat (Victoria) Gas Company. Mr. William Ford has retired from Stockton-on-Tees, and Mr. Matt Dunn has succeeded him, with Mr. Ford as Consulting Engineer. Mr. David Fulton has taken up the work of his late chief (Mr. W. Blair) at Helensburgh. Mr. A. Morton Fyffe has removed from Nelson to Blackburn, and has been succeeded at Nelson by Mr. Dugald Currie. Mr. F. Higginson has retired from the Managership of the Broadstairs Gas Company; and Mr. W. Dallas has been appointed Secretary and Manager. Mr. Norton H. Humphrys has resigned from Salisbury, and has been succeeded by Mr. William Fielden. Mr. W. C. Jackson has gone from Merthyr Tydfil to Neath, in succession to Mr. R. A. Browning. Mr. Leonard J. Langford succeeded his father as the Engineer and Manager of the Stoke-on-Trent Gas-Works. Mr. J. W. M'Lusky has taken charge of the Airdrie Gas-Works. Mr. J. M'Nicholl has taken up the duties of Engineer and Manager of the Mossley Corporation Gas-Works. Mr. W. H. Mainwaring has succeeded his late chief (Mr. John Carter) at Lincoln. Mr. H. C. Page has been appointed Engineer of the Canterbury Gas and Water Company. Mr. Samuel Shadbolt has taken up the combined duties of Engineer, Manager, and Secretary of the South Bank and Normanby Gas Company; while Mr. Walter Shadbolt has succeeded his brother at Fleetwood. Mr. C. S. Shapley is now the Engineer and Manager of the Southend Gas Company. Mr. F. Shewring has transferred his services to the Tawe Valley Gas Company. Mr. H. Singleton (formerly draughtsman and chemist) has been appointed Engineer and Manager of the Huddersfield Corporation Gas-Works, in succession to Mr. Edward Harman. Mr. James Taylor has gone from Mossley to Weston-super-Mare. Mr. Reginald Thomas has been appointed Manager at Droitwich. Mr. E. B. Tomlinson has taken up the duties of Engineer of the Nechells Works of the Birmingham Corporation. Mr. J. G. Tooms has been appointed by the Christiania Corporation engineer for the construction of their new gas-works. Mr. E. J. Wellens obtained the Superintendentship of the Grimesthorpe Works of the Sheffield Gas Company. Mr. T. Wilton has retired from the position of Superintendent of the Products Department of the Gas Light and Coke Company. Mr. H. R. Wimhurst is the new Engineer and Manager at Bury St. Edmunds. Mr. E. D. Wooton has gone to Abertillery.

There have been jubilees during the year. Sir Corbet and Lady Woodall have celebrated the jubilee of their marriage; Mr. G. R. Hislop of his fifty years' service as Engineer of the Paisley Gas-Works; and Mr. J. H. Penney of the same length of service at South Shields.

To the Great Beyond.

During the year, heavy tribute has been laid by Death upon the gas industry. We will not mention all the names of friends with whom it was a great grief to part, and by the loss of whom the industry is the poorer. The roll of departed ones includes the names of Mr. Edward Allen, Mr. William Blair, Mr. Thomas Bower, Mr. John Carter, M. de Brouwer, Mr. Joseph Hepworth, Mr. William Langford, Professor Vivian B. Lewes, Mr. Adam Macpherson, Mr. E. H. Millard, Mr. Joseph Morris, Mr. Henry O'Connor, and Mr. William Swinburne. The war has also removed several who have been gallantly fighting for King and country; among them being Captain Richard B. G. Glover and Mr. Bryan Crossley. From among those engaged in the manufacture of plant and appliances for the gas industry, there have been removed Mr. Thomas S. Clapham, Mr. William Clapham, and Mr. R. Clayton (Cannon Iron Foundries); while Mr. G. J. Eveson is another well-known name in the industry's trading world. Men who have held distinguished place in gas administration, but are now no more, are Colonel H. Oakden Fisher, Dr. G. A. Jeffery, Sir E. Chandos Leigh, and Mr. Edward Wright. Mr. R. Forbes Carpenter, the highly respected former Chief Inspector under the Alkali Works Regulation Acts, also passed away during the year.

Accidents, Etc.

Of fatal accidents on gas-works there have fortunately been but few, having regard to the dimensions of the industry and the ramifications of its operations. Not more than a score of deaths have been recorded in our columns as the result of accident; but the most notable one, and the most inexplicable, was the explosion at the Beckton Gas-Works, during the removal of a quantity of benzol. The assistant still man was killed. There have been a few explosions, suffocations, and suicides; but the number has been less than has been recorded for some years past.

In Conclusion.

Now we have come to the end of our annual task. The retrospect is not altogether a cheerful one; but there are silver linings to the clouds. The manner in which the industry is passing through the cataclysm of unprecedented circumstance is proof of its great vitality and capacity for endurance. It is, too, a matter for congratulation that the industry has been found so useful, and indeed so indispensable, in the war. But enough of the past. We stand at the close of this year of terrible experiences with unabated confidence as to the ultimate victory of our country and her Allies; and when victory has been secured, and peace restored, we hope to see the gas industry, and have assurance that it will, gradually move to more normal conditions, and then continue its progress to greater service and usefulness. The circumstances of the future may not all be exactly as of the past; but in the industry's affairs a flexibility has ever been shown which has enabled it to bend to new conditions, and yet make greater advance. As in the past, so in the future. May the New Year see a restoration of Peace through the decisive defeat of our enemies, and the world be again placed in a state of composure. That is the prayer of all.

Mr. Jones on the Origin of the Sliding-Scale.

On this subject an interesting letter from Mr. H. E. Jones appears to-day in our "Correspondence" columns. In this, he puts on record his recollections as to the initiation of the sliding-scale, and the adoption of it by the Commercial Gas Company, which recollections are confirmed by the volumes of the "Journal." It is a little strange that any question should have arisen concerning the point as to whom is due the credit for the origination of the sliding-scale. The "Times" is not infallible; and it so proved itself when attributing to Mr. Cripps the authorship of the sliding-scale as applied to statutory gas undertakings other than those working under a maximum price. If Sir George Livesey had not been the originator of the sliding-scale, he would have been the first to have said so during his lifetime, when, in print and otherwise, the credit of being so was placed upon him, and him solely. He was not in the habit of receiving personal credit unless merited; and, if anyone else was entitled to share credit with him, he never hesitated to say so. We shall hold Mr. Jones to his promise that, if he has time to go further into records, and they are of interest, he will place them at our disposal. His close association with the legislation of that momentous year for the gas industry, 1875, qualifies him for giving a personal touch to the information conveyed by the printed records, and to bring from behind the scenes much that imparts added interest to those records.

French Gas Consumers and Toluol Extraction.

Relative to the necessity of those engaged in the war to make the utmost of their toluol resources, it will be remarked with interest, from a report appearing in other columns, that the French Government are not giving the consumers of gas the opportunity of making a claim for compensation through price for any supposed injury occasioned by the extraction from gas of the substances required for war purposes. It is recognized by the French authorities that, used in incandescent burners and for heating purposes, there is no material or assessable injury occasioned to the gas, and that consumers using flat-flame burners have only to adopt incandescent ones to recoup themselves over and over again for depreciation of the luminosity of the gas *per se*. A Bill has therefore been introduced into the French Chamber to relieve gas undertakings from all liability owing to any contravention of their statutes or contracts due to any acts performed for the benefit of

the State, and solely to meet military requirements. The Minister responsible for the drafting of the Bill says: "If the matter is looked at from an equitable point of view, and by comparison with the burdens imposed on the great majority of citizens by a state of war, one is forced to the conclusion that an indemnity is not justified, as it merely involves granting an indemnity to users of gas owing to the present position of their country." There are other interesting points in the report; among them that Germany has taken the necessary steps to treat illuminating gas in the principal cities—a course which was adopted there long before the war in connection with coke-oven gas.

A Question in Parliament.

In the House of Commons, Mr. Will Thorne, the Secretary of the Gas Workers' Union, has asked the Minister of Munitions whether he is aware that the loss in illuminating and heating power of gas caused by the extraction of benzol, toluol, and xylol can be made good by the use of oil and cannel; and if he will require gas undertakings to use artificial substances to maintain the quality of the gas or otherwise reduce the price to the consumers. Mr. Thorne evidently does not understand the extent of the "loss" so far as incandescent lighting and heating purposes are concerned; nor does he appreciate that, at the present price of oil and cannel delivered, the cost of enrichment would not be "worth the candle," and that, as a matter of fact, consumers might have to pay a still higher price for their gas on account of the enrichment. Mr. Thorne has had an answer to the effect that the cost and difficulty of obtaining the enriching materials required would restrict the possibility of adopting such processes, and that the deterioration of the quality of the gas is hardly appreciable.

Gas in Train Accidents.

No human being can do aught else than sincerely deplore such terrible consequences as occurred in the railway accident at Jarrow. But there must be protest against the senseless ravings and vapourings that one finds in non-technical papers and prejudiced electrical journals regarding the use of gas on trains involved in such accidents. The public newspapers delight in obtaining a sensational item, whether or not there is any real foundation for it; and the interested electrical papers think it their duty to foment bias and agitation notwithstanding that the foundation for what they are doing will not stand the test of technical investigation. In this Jarrow accident (as will be seen by the report of the evidence at the opening of the Board of Trade inquiry), one guard stated that he "thought" gas was escaping from the cylinders of the leading coach on the passenger train; and another guard "thought" the gas was coming from the roof lamps of the carriage as the roof was alight. An engine driver was unable to say what caused a jet of flame under the carriage; but he "did not think" it came from the ashes of the engine. It is all particularly inconclusive testimony; but the evidence of Mr. A. C. Stamer, Acting Chief Mechanical Engineer of the North-Eastern Railway Company, helps us to test it. He stated that one of the cylinders of the leading coach was burst at both ends, and lying at the rear of the engine; while the others had been staved in, or otherwise burst. All the low-pressure connections were broken away from the cylinders. This being so, how could the jets of flame at the roof have been due to burning gas? With the cylinders in the condition described, the high-pressure gas must have found speedy exit, and would naturally be at once dispersed. In an account published before the inquiry, one man stated that he noticed the smell of gas in the burning carriage. No doubt he did smell something, with the fumes from the engine about him. But has it occurred to those writers who have made use of this statement to condemn gas as to why, if there was gas imprisoned in, and mixed with the air of, the burning carriage, it did not explode with flames there? The amount of senseless talk there is on this subject is astonishing; and it is more so that the electrical papers should indulge in the folly of subscribing to it.

Sulphate of Ammonia Exports.

While coalowners and shipowners are engaged in the (to them) congenial task of skinning the gas industry, the industry, which is trying to do its best for everybody, including the Government, is being subjected to buffetings all round. We have local authorities and consumers asking for a reduction in the price of gas on account of the services being rendered in a common cause; coke consumers seem to think that an extravagant price is being asked for the commodity although the coal from which it is made is costing so much, and though in some areas there is not enough coke to meet the demand; tar, too, is not in particularly good market favour, and nobody wants much pitch; and now, after the Sulphate of Ammonia Manufacturers' Association have arranged with the Board of Agriculture to reserve for the British farmers a supply of sulphate of ammonia at a price much below the ruling market value, the "Times" attacks the gas industry through the Government because the latter have not prohibited the export of sulphate. But Mr. F. D. Acland has written to the "Times" pointing out the arrangement that had been made regarding price and reservation of supply. Mr. D. Milne Watson, the Chairman of the Sulphate of Ammonia Manufacturers' Association, also sent to our morning contemporary still more explicit information, which showed that the British farmers have so far taken less than one-fifth part of the quantity reserved for their autumn dressings. The "Times," however, has not seen fit to publish Mr. Milne Watson's letter dealing with this point. It is given in our "Correspondence" columns to-day.

Patents in Enemy Countries.

Some modification has been made by the Board of Trade, under powers reserved to them, in the Proclamations issued from time to time in relation to trading with the enemy. In the matter of the payment of patents, designs, and trade marks fees, the Board now give licence to persons residing, carrying on business, or being in the United Kingdom to pay on their own behalf or on behalf of any person or persons in the United Kingdom and on behalf of anyone in any other part of His Majesty's dominions who has been authorized to make such payments by the Government of that part of the dominions, any fees necessary for obtaining the grant or the renewal of patents or the registration or renewal of designs or trade marks, in an enemy country, and to pay to enemy agents their charges and expenses in relation thereto. The Board further give licence to persons residing, carrying on business, or being in the United Kingdom to pay on behalf of an enemy any fees payable in the United Kingdom on application for, or renewal of, the grant of patents or registration or renewal of designs or trade marks, and to pay agents in the United Kingdom (including themselves) their charges and expenses; also to pay on behalf of an enemy to any persons in any part of His Majesty's dominions outside the United Kingdom, subject to the authority of the Government of that place, fees payable on application for, or renewal of, the grant of patents or the registration of designs or trade marks in such part of His Majesty's dominions, and to pay such persons their charges and expenses.

Forthcoming Trade Exhibitions.

Among the various visible signs of a growing determination to secure what benefit may be possible for the manufacturers of this country as a result of the crippling of Germany's export trade, may be mentioned the industrial exhibitions organized by the Board of Trade. In May last, at the Royal Agricultural Hall, Islington, the Board arranged a British Industries Fair, at which large numbers of manufacturers and wholesale buyers were brought in contact, and visitors were able to see for themselves how much has been accomplished by British manufacturers in reviving certain branches of industry which had suffered severely from German competition. In fact, the success was such that the Board wasted no time before starting to make preparations for another display of a similar character in 1916. The arrangements for this Fair have been completed; and it is announced that it will be opened towards the end of February, in the buildings of the Victoria and Albert Museum, South Kensington. As on the previous occasion, admission will be by invitation of the Board of Trade alone, and will be restricted to *bonâ fide* buyers for the trades concerned. These trades (ones which have been more particularly the object of German competition) are limited in number, and include glass; and only British manufacturers engaged in them will be permitted to exhibit. Looking further ahead (but not too far, having in mind the importance of the end in view) an Industries of the Empire Fair is projected for 1917—not, however, this time by the Board of Trade, but by the British

trade associations themselves. This it is intended to hold early in the year, in a building (having three-and-a-half times the total area of Olympia) to be erected for the purpose at Willesden Green. The idea is that it shall be the greatest trade exhibition ever organized, seeing that it will, as already mentioned, be the outcome of co-operative action on the part of the principal trade associations of this country. Unlike the first-named display, it will not be confined to particular trades, but will be open to British manufacturers generally; and it is hoped to have between two and three thousand exhibitors, representing upwards of seventy distinct trades.

THE LATE PROFESSOR LEWES.

An Appreciation by Sir Boverton Redwood, Bart.

REFERRING to the late Professor Vivian B. Lewes, in an article appearing in the "Petroleum World," Sir Boverton Redwood, Bart., shows a keen appreciation of the many sterling qualities of his, and our, late friend.

Vivian Lewes, he says, had a striking personality, which at once arrested attention. He ever had in view the silver lining of the darkest cloud; and he retained to the last a youthful buoyancy and sunny outlook which gave a charm to his manner and rendered him a delightful companion. Though of most amiable disposition, he was in matters of principle a good fighter; optimistic in the best and broadest sense; patient under reverses; and not unduly elated by success. He was modest as to his own attainments, and exceptionally generous in his recognition of the abilities of others. Probably his greatest gifts were his strong common sense, his intuitive perception of proportion, and his good judgment. Unquestionably, it was his possession of these qualities which rendered his advice on matters involving the application of science to industrial problems so valuable and so much sought after. Above all, however, he had a high sense of duty and of consideration for others. In all probability it was this feature in his character, coupled with unusual will-power, which brought about his untimely death; for when he left London for the last time to deliver a lecture in Wales on matters connected with the war, he was more ill than he recognized or admitted. He was urged not to go; but his characteristic reply was: "I have never disappointed an audience yet, and I cannot do so now." His illness, however, increased so rapidly that when he reached his journey's end he was in a state of collapse, and double pneumonia supervened. Thus he died, in harness, as he would doubtless have chosen to die, in the full vigour of his manhood, with the promise of many more years of useful service unfulfilled; and the world is the poorer.

Professor Lewes was universally recognized as a high authority on coal gas; and the lectures which he delivered on the manufacture and use of gas before the Gas Institute, the Institution of Gas Engineers, and the Royal Society of Arts, not only gave instruction in his inimitably delightful manner to the large audiences which they invariably attracted, but form an enduring record of his mastery of the subject. Nowhere was he a greater favourite than at the lecture table of the Royal Society of Arts. Presiding at the first of the course of lectures which he delivered before that Society during the present year on "Modern Munitions of War," Sir Boverton Redwood was, he remarks, able to inform an audience which filled every seat in the great room that since his first appearance there twenty-five years ago Professor Lewes, with the completion of the course, would have occupied the platform on no less than sixty occasions. He invariably lectured without using a single note, and was never at a loss for words. He possessed in a high degree the power of presenting scientific facts in attractive and lucid language, devoid of unnecessary technicalities, and enlivened by humorous allusions.

Scottish Junior Gas Association (Western District).—It was stated in last week's "JOURNAL," on the authority of Mr. W. Grafton, that an adjudication had been made on last year's papers read before the Association, and that the two prizes had been awarded; but we learn now that the paragraph was based on a misconception. As a matter of fact, Mr. Grafton is one of five adjudicators appointed by the Council; and it is the opinion of the majority of these five that will settle who is to be awarded the prizes.

The Employment of Maimed Discharged Soldiers by Gas Undertakings.—The Director of the Strasbourg School for One-Armed Men, Herr Fritz Iwand, has communicated to the German Technical Press suggestions for the employment of men who have lost a hand or arm in the war. In regard to men who had been previously engaged in the gas industry, he says that, while the loss of a hand or arm will prevent them being employed again as machinists, stokers, or boiler men, they can well do duty as lamplighters, meter inspectors, &c. Outdoor work, he remarks, is more suitable than indoor work for men who have been so injured in the war; and people must accustom themselves to the sight of their one-armed and left-handed heroes.

ELECTRICITY SUPPLY MEMORANDA.

THE Osram lamp is not by any means having things all its own way. It seems to be an Osram belief that nothing has ever been done, or can ever be done, in connection with tungsten filaments that does not infringe the Osram patent rights. The result of this opinion is that anyone who essays to make a tungsten filament lamp, without paying tribute to the Osram people, will in all likelihood be called upon to answer for his temerity in the Law Courts. As we glance back, there appears to have been a perfect shoal of cases in which proceedings have been commenced to restrain infringement of the Osram patent; and, in various instances, the defendants have abandoned all defence, and given way before the Osram forces. Not so the Pope Electric-Lamp Company. They faced Osram Lamp Works, Limited, before Mr. Justice Joyce, and won. They faced their antagonists again in the Court of Appeal, and have sent the Osram Company home with the words of Lord Justice Bankes (supported by the Master of the Rolls and Lord Justice Warrington) humming in their ears, which words told them that, in the opinion of the Court, there is a substantial difference between the defendants' process of manufacture, and the process described in the plaintiffs' specification—in fact, the conclusion their Lordships came to was that the plaintiffs had failed to establish their case from whatever point of view it could be regarded. It is for the Osram people an unpleasantly decisive statement of opinion. Under the patent being worked by them—that granted to Dr. Alexander Just and Franz Hanaman—the filaments are made of pure tungsten by mixing finely divided tungsten with a binding material, which causes the cohesion of the particles, so forming the filaments from the mixture, and then carbonizing them. The defendants pointed to what they contended were distinct differences in the processes of manufacture, inasmuch as in their case they do not carbonize the filaments, and do not pass an electric current through them, but heat them in an electric furnace; and, further, they do not use an atmosphere of steam and hydrogen, and do not equalize the filaments. It was also pointed out that the making of filaments with tungsten was old. The Court, as already stated, cordially agreed with the defendants that their patent does not infringe the Osram one. Now we suppose Osram Lamp Works, Limited, are ruminating over the question of whether they shall go to the House of Lords, or whether they had better leave things as they are.

An Osram Defeat.

Coal Supplies.

The "Electrician" states that already reports are being received from various parts of the country which show there is considerable difficulty in getting coal supplies through to generating-stations; and coal reserves are being eaten into more rapidly than is comfortable for the peace of mind of the managers. In one case, it is stated, the deliveries are so deficient in relation to current needs that a stock of 20,000 tons of coal is being shipped away at the rate of 1000 tons per week. During the autumn, electricity stations, as well as several other important works which we need not name, were warned that the winter would be a difficult one in respect of coal supplies, and that, in consequence, stocks had better be accumulated betimes to an unprecedented amount. It is these greater stocks that were, or should have been, put by when there was the opportunity that are being drawn upon at the present time. Then why grumble? However, the "Electrician" says that the railway companies are more to blame for the shortage than the collieries, and that the present position is sufficiently serious to demand the immediate action promised by the Board of Trade. What was the nature of the action promised by the Board of Trade? We did not know that the Board were in the position to promise anything very definite in the way of remedy. They were suggesting the pooling of privately owned railway waggons, and having their comings and goings regulated in the general behoof. But if this plan (which is not going to mature just yet) is eventually carried out, the country will have to thank the Luton Town Council for contributing to the common stock fifteen new railway waggons which they propose to purchase in order to secure coal for the electricity works. Of course, we do not think this would be fair; but if the pooling scheme is carried through, all must share and share alike. "It is quite certain," says the "Electrician," "that those who are responsible for the delivery of coal to electricity supply stations do not fully realize the extent of their responsibilities, or there would not be the present shortage." There is more in the present position than a mere failure to recognize responsibilities; and, if our electrical contemporary will start on the job, it will find the coal industry, its men, and its methods combine to make a most interesting study.

An Acute Position.

There is the "Electrical Times" too. It asserts that the coal position is a very hazardous one. "There are," it said at the time of writing last week, "at least three electric stations in London that are short of coal." During the preceding week-end [Dec. 18] one of those stations had a supply for less than a fortnight, another for only three weeks, and the other for only a month. Our contemporary asks, "What has brought us to this pass?" and it replies: "The most salient fact is that the Price of Coal (Limitation) Act, 1915, reacts against home supplies with

particular severity. This Act sets a limit to the price at which coal may be sold for home consumption. There is no such limit to the price of coal sold for export; therefore it pays the collieries far better to sell abroad. That may be unpatriotic of them individually; but it was bound to occur under competitive business conditions." Then later on it is submitted that the Act should be amended, so as to restrain the strong temptation to ship abroad. Our contemporary seems to have overlooked the Coal Exports Committee, and the principles that are guiding them in their operations. They are seeing first that there is sufficient coal for home needs; second, are looking after our Allies before neutral countries; and, third, are keeping a strict eye on the export of coal to neutral countries. The "Electrical Times" should study the Board of Trade returns; and it will see the considerable drop there has been in the exports to neutrals. Under the circumstances, we rather think it has been writing without being in intimate touch with the facts. It is true the coal owners are not limited in the price they can ask for coal for abroad; but they cannot send coal out of the country save under licence from the Coal Exports Committee. This Committee are, under the circumstances, a necessary supplement to the Act. However, besides the suggested and unnecessary amendment of the Act, the remedies proposed by our contemporary are that the number of available steamers should be increased, and that Government pressure should be brought to bear on coal merchants to cause them to give power stations supplying munition works preferential treatment. We repeat the question, What did the electricity supply stations do during the summer, when freights were lower than now, and supplies more plentiful, to protect themselves against a condition of things as to the probability of which there was warning? The trouble does not apply to London only. The Manchester Corporation Electricity Department have had deliveries reduced by 50 per cent., and the stock of 21,000 tons that existed at the end of July is down to 12,000 tons now.

Lamp Comparisons.

There has been a fairly good absence for some time of the entertaining comparisons made by electricians as to the relative costs of gas and electric lighting. But there is a little breaking-out again. Messrs. Johnson and Phillips, Limited, are the authors of a fresh comparison, which naturally puts high-pressure gas out of the running, gives to the so-called "half-watt" lamps second place, and the lead is easily taken by the "Metroflam" arc lamp which (this is, of course, quite between our readers and ourselves) Messrs. Johnson and Phillips produce for the market. In these days, we do not see many of this particular brand of lamp about; and this is very remarkable in view of the character that the firm in question modestly give to it. But perhaps even electricians who are buyers of arc lamps, and have a capacity for making comparisons, are inclined not to take everything for granted that reaches them from electrical sources. The comparison is as to the cost of running one 2000-candle power lamp for 1000 hours. The "Metroflam" lamp is an 8-ampere one, running five in series, on 220 volts direct current. Here is the comparison:

Metroflam Arc Lamp.—Carbons 15s. 6d.; current at 1d. per unit, £1 10s.; labour, 5s. . . . . Total	£2 10 6
Half-Watt Incandescent Lamp (Life 800 Hours).—Renewal of lamps, £2; current, at 1d. per unit, £4 3s. 4d.; labour, breakages, &c., 2s. 6d. . Total	£6 5 10
High-Pressure Gas-Lamp.—Gas at 2s. per 1000 cubic feet compressed, £8; mantles, &c., 8s. 4d.; labour, &c., 5s. . . . . Total	£8 13 4

Now electrical men would be very glad to know that they could get a flame arc lamp of an actual 2000-candle power to run for 1000 hours for £2 10s. 6d.; and gas people would be very sorry for themselves if working costs for a 2000-candle power high-pressure lamp mounted up to £8 13s. 4d. per 1000 hours. If these figures were true, then the electrical people would be able to take contracts for arc lamps at a much lower price than they do; while, on the other hand, gas undertakings throughout the country would in out-of-war times be losing money hand-over-fist on the high-pressure lamps they have on contract. Working-out the current consumption, it is seen that, for the 2000-candle lamp, it is only put at 352 watts per hour. The consumption is about right, calculating on amperage and voltage; but the efficiency works out to the extraordinary figure of 5·7 candles per watt! The electricians would like to see this photometrically demonstrable. These lamps, too, have modest appetites for carbons, which only work out to 0·186d. per hour. As to labour, well, we will not quarrel with that, as the firm take the same figure for high-pressure gas-lamps. They also attribute an efficiency of 1 candle per 0·5 watt for "half-watt" lamps, which they ought to know is photometrically untrue. But what is still more untrue, and quite unworthy our competitors, is that they declare that to obtain 2000-candle power with high-pressure gas-lamps requires a consumption of 80 cubic feet of gas per hour, which represents an efficiency of only 25 candles per cubic foot, while there are low-pressure gas-lamps that will give them an efficiency equal to this without the trouble of compressing the gas. We believe that with the Keith lamp a guarantee of 2000-candle power would be given on a consumption of 33½ cubic feet of gas of (say) about 500 B.Th.U.—a vast difference from the absurd statement given in the electrical comparison. In the comparison, there is nothing allowed for depreciation of light through the need, with the high-power electric lamps, and their eye-injuring intrinsic brilliancy, of screening the source of light; while with the large area surface of the high-pressure gas mantle, the intrinsic brilliancy being relatively low, there is consequently not the same necessity for largely cutting down the light by globes or screens.

Varied Power.

It was an excellent practical paper that Mr. W. A. Tookey read before the Junior Institution of Engineers yesterday week; and we are afraid that parts of it will not be altogether agreeable reading for our electrical friends. The author has a little tilt at them over the variety of power that is to be found in some generating stations. The one which he puts forward as illustration must surely be an exception for variety. The main motive power is steam; but there is a generating set driven by suction-gas plant, another by a Diesel oil-engine, and a third by a town-gas engine. The mechanic who can deal with such a mixed collection as this must be a paragon. But while Mr. Tookey twits the central station engineer (with whom we are not siding for his hybrid plant), the latter can turn round and say that in variety there is safety, and that he can change and change about just as economy dictates, though the economy to be so gained must be more than wiped out by what is entailed by having four different plants with which to deal. For instance, there is different fuel to be bought and stored for the steam, suction-gas, and Diesel plants. The town-gas engine is the only one of the quartette that does not cause the engineer any worry in regard to fuel purchases, market prices, storage, and labour in the operations preceding the development of power by the prime mover. But Mr. Tookey points out that it is unfortunate that, though the gas-works is the only place where the utmost value is derived from the coal used, the gas is produced at such a cost as to make its use only commercially practicable for relatively low-power engines. This is due to the limitations imposed by the variety of uses to which the mono-gas supply is put. If clean gas of lower grade than that which is most serviceable for domestic use were available from the gas-works, gas would have very much larger application for engine purposes. There are gas-works that have parliamentary authority to supply power gas (gas of lower grade than the ordinary supply); and possibly a dual supply of gas in industrial areas will be a development in the future.

Power Costs.

But on the point of costs, the electrical people will not bless the name of Tookey, though he deals very fairly with the relative positions of electric-motors and gas-engines. The former has advantages which the latter does not possess. Adaptability and convenience must go a long way; but "usually the cheaper operating cost of the gas-engine determines that of the two it is preferable for purely commercial reasons." Gas-engines have been wonderfully improved. In the early days, the compression pressure rarely exceeded 50 lbs. per square inch; but compression pressures more recently have been in the neighbourhood of 120 lbs., and even 150 lbs. The average engine demands 19 cubic feet of 500 B.Th.U. gas per B.H.P.-hour. With the price of gas for power purposes at 20d. per 1000 cubic feet, the cost of generating 1 B.H.P. hour would be 0·38d. Then taking the load at five-eighths of the full load, with a motor about 0·89 unit would be consumed per B.H.P. hour; and therefore, to secure similar results, this should be procurable at the same price as the 19 cubic feet of gas. To be equivalent to gas at 20d. per 1000 cubic feet, electric energy would have to be sold at 0·427d. per unit. In other words, electric current for motor purposes at 1d. per unit, may be taken as being equivalent to gas at 46d. per 1000 cubic feet. That is not a comfortable comparative condition. On the other hand, in initial costs the electric-motor has first place. The example taken by Mr. Tookey is a 20-horse power machine. A motor of this power fixed would cost about £60; a town-gas engine of equal output would cost nearly double; and a suction gas-engine and producer nearly three-and-a-half times as much. The town-gas engine should be debited with £6 per annum as additional standing charges to cover higher depreciation and interest; while the suction-gas plant should be debited with an additional £15 for the same reason. The suction-gas plant is shown to be "out of it" compared with the town-gas engine; but, in comparison with the electric-motor, the town-gas engine, through economy in running, would soon rub out any difference in the additional standing charges. As to the suction-gas plant (the facts concerning which are pretty well known now, and not to its advantage, unless in a district where town gas is very dear), about 2 lbs. of anthracite are required to generate the equivalent of 1 electrical unit of energy. The average cost of generating a unit of energy with suction-gas engines and plant (Mr. Tookey says) does not fall far short of 0·75d. per unit, when all charges are brought into account, with anthracite at 34s. per ton. In other words, while the cost of fuel is only about 0·375d. per unit, the other expenses usually amount to about as much again. The figures supplied by Mr. Tookey are good for competitive purposes.

The Chairman (Mr. Arthur R. Ling), at the last ordinary monthly meeting of the London Section of the Society of Chemical Industry referred to the loss the Society had sustained by the death of Professor Raphael Meldola and Professor Vivian B. Lewes. Professor Meldola, he said, was one of the Society's most illustrious Past-Presidents; and the loss of him to the country at the present time was very serious.

THE "JOURNAL" AND THE ORIGIN OF THE SLIDING-SCALE.

Mr. Hunt's Oblique Retort.

THE circuitous course of replying in the columns of the "Gas World" to the editorial article that appeared on the above subject in the "JOURNAL" for the 14th inst., and which article had not been published in the columns of our contemporary, has been chosen by Mr. Charles Hunt. Indirect action of this kind is singular, and quite foreign to Mr. Hunt's usual observance of the dictates of courtesy. However, there is palliation in his admission that, whatever may have been the attitude of the "JOURNAL" towards the sliding-scale in 1875, "the memory of bygone time has been far more than completely effaced by the important services which have since been rendered by your contemporary to the cause of the sliding-scale for more years than I care to remember." We appreciate very sincerely this testimony from Mr. Hunt. At the same time, we cannot help feeling—although not immediately responsible for the editorial articles that appeared in our columns in 1875—that we are presented with something in the nature of a psychological phenomenon when we are told that "the *memory* of this bygone time has been *far more than completely effaced*," and yet, earlier in the month, the writer of these words bluntly asserted, without any qualification whatever, the strong opposition of the "JOURNAL" to the "innovation" of the sliding-scale. The words and the act are, at any rate, a distinct contradiction. Again, Mr. Hunt now declares that, if he had thought for a moment that his statement as to our early attitude towards the sliding-scale could be at all open to question, he would not have made it, "since it was neither my intention nor desire to re-open *forgotten* controversies." The act of recalling, and the words "strongly opposed," hardly support the profession as to intention or desire. Nevertheless, we accept the present statement in the spirit in which it is believed it has been offered.

But Mr. Hunt proceeds to attempt to justify the assertion as to the "strong" opposition; and he does this by asking his readers to peruse what the "JOURNAL" said in one half of the year 1875, and then, completely discharging their minds of the *terminus a quo*, read what was said later in the year, and consider only the *terminus ad quem*. By this process, they would see that there had been a complete editorial *volte-face*. But we rather think that the 1875 readers of the "JOURNAL"—or all but one of them—who were in intimate touch with the whole of the circumstances of the times must have read the articles in the second half year with present in their minds the arguments that had been advanced earlier, and it is by the aid of what was said in the first half that interpretation must be given to what was said by the writer in the second half. Mr. Hunt himself admits that the "JOURNAL" in the first half of that eventful year 1875 "expressed itself as being in favour of a sliding-scale that should operate *both ways*." But he seems to fix the change in attitude as occurring in our issue of June 15 of that year, when, he says, there "came the announcement of the 'JOURNAL'S' adherence to the declaration which had already been made on behalf of the associated companies against any sort of sliding-scale of dividend." This does not exactly express what was then said, and it carefully omits some important passages. We quoted these on the 14th inst. But let us do so again:

> We gather from the speech of Sir E. Beckett that the "associated companies" object to any sort of sliding-scale of dividend; and so, in fact, do we. We only support the up-and-down scale as a simple measure of fairness. *If a company are to be fined, for that is what it practically comes to, when they exceed one price, it is but just that they should be rewarded when they make another and lower charge.*

Mr. Hunt omits the final passages. But what objection can be raised to the attitude there expressed? They are not the words of a writer "strongly opposed" to the "innovation" of a sliding-scale. These and other statements have a distinct bearing upon the articles that succeeded; and they indicate the extent to which, and the objects for which, the "JOURNAL" was contending, at the inception of new legislation, in relation to the circumstances of the time, and the conditions and experiences preceding. We repeat that it is clear, taking the articles as a whole and not piecemeal, that opposition was more directed to the terms than to the "innovation," and that the use by Mr. Hunt of the words "strongly opposed" is not justified.

In a note appended to Mr. Hunt's letter, it is remarked, "That our contemporary should take this up thus rancorously is passing strange." Those of our readers who have perused our editorial article of Dec. 14 (which article was solely written with the view of not allowing Mr. Hunt's statement to spread the notion that at one time the "JOURNAL" was bitterly opposed to a sliding-scale of price and dividend of any sort) will be rather puzzled to make the term "rancorously" fit what was then written. Neither in the matter of the applicability of terms nor in that as to what constitutes courtesy is judgment the monopoly of any single person either westward or eastward; and we confidently leave judgment on these points to our readers.

Since the appearance of the letter which has called for these comments, it has been suggested to us that the "dig" at the "JOURNAL" of forty years ago, and the indirect course adopted of replying to our editorial article of Dec. 14, may have some connection with a little discussion of not long since on the subject of South Suburban meter-rents. Lest any others should think this, let us say at once that we do not believe that any such little difference of opinion on a question of policy would lead Mr. Hunt to take a vindictive course. This matter would not have been referred to, but, having been mentioned, we should like it to be understood that we emphatically dissociate ourselves from any such view.

PRESENTATION TO MR. NORTON H. HUMPHRYS.

A PLEASING little ceremony took place at the Salisbury Gas-Works on the 23rd inst., when Mr. Norton H. Humphrys was requested to meet the employees in the general office during an interval between the retort-house charges—a time that would admit of the whole number being present. Mr. William Fielden (Engineer and Manager of the Company) presided, and after recounting the circumstances that had resulted in the gathering that afternoon, called on Mr. J. C. Watts, the oldest employee of the Company and Works Foreman, to address the meeting.

Mr. Watts said that personally he felt it a great privilege to be deputed to voice the views that had led up to the meeting that day. Many of the staff had enjoyed the advantage of being associated with the late Engineer and Manager for quite a long period. One or two, himself among the number, could remember welcoming him on his arrival in Salisbury in 1883; and they all felt that his connection with them should not be closed without some recognition of the good feeling that had at all times existed between them. Consequently, he now had the great pleasure, on behalf of the whole working staff, he believed without one exception, of asking Mr. Humphrys to accept, with their best wishes, an illuminated address, together with an umbrella for Mrs. Humphrys, whom they thought ought not to be forgotten on the present occasion.

The address, which was mounted in a handsome carved oak frame, and was beautifully executed in gold and colours, was as follows:

> Presented to Norton H. Humphrys, Esq., Assoc.M.Inst.C.E., F.C.S., by the undermentioned Officers and Staff of the Salisbury Gas Light and Coke Company on his retirement, after 32 years' service, as a token of their regard and appreciation of his many thoughtful acts of kindness to them, with every good wish for his future health, happiness, and prosperity. 30th September, 1915.

It also bore the names of the subscribers. The handle of the umbrella was mounted with gold.

Mr. J. W. Frost (Accountant), Mr. T. Crowdy (Manager's Assistant), Mr. G. Bowering (Outdoor-Foreman), and others having spoken in similar terms,

Mr. Humphrys (who was enthusiastically received) said he could not find words that would adequately express all he would like to say, on receiving from his old friends such a splendid recognition of their regard and esteem, which was accepted with as much pleasure as they had expressed in presenting it, and would always have an honoured place in his home. Mrs. Humphrys was not yet aware of their kindness to her; but he was sure he could say, on her behalf, that she would also be very much pleased with the handsome and useful present, and would value it highly. He did not forget that these presentations had been made at a time when they were all occupied with matters of much greater moment, and also when there were many extra expenses, and the necessaries of life were costly, so that it was not so easy to find an extra shilling, as it would be under happier circumstances. He thanked Mr. Frost for undertaking the necessary arrangements, and the several speakers; and also Mr. Fielden for presiding.

The awards of premiums made by the Society of Engineers in respect of papers published in the "Journal" of the Society during 1915 included the President's gold medal to Mr. Arthur H. Barker, B.Sc., for his contribution entitled "Some Future Developments in Heating and Ventilation;" and a Society's premium, value £3 3s., to Mr. Sydney G. Turner, Barrister-at-Law, for his paper entitled "Law and Engineering, Some Points of Contact." These papers were noticed in the issues of the "JOURNAL" for May 18 last, p. 402, and Oct. 12, p. 91.

Captain G. H. COATES, of the 9th Durham Light Infantry (Foreign Service Battalion), died very suddenly at Darlington on Christmas Day. An old territorial, Captain Coates rejoined for foreign service shortly after the outbreak of war, and the cause of his death from heart failure is to be found in overstrain as a consequence of his arduous military duties. For many years Captain Coates had been associated quietly, but effectively, with the large undertaking built up by his father, the late Mr. Thomas Coates, at the Whessoe Foundry, Darlington. He was attached more to the commercial side of the business, though he had been trained as a civil engineer, in which capacity he had done valuable work in different parts of Europe. He was Joint Managing-Director with his brother (Mr. Alfred T. Coates) of the Whessoe Foundry, and was only 41 years of age. He was a keen sportsman, and popular in society. He leaves a widow and five children.

EVAPORATION OF NAPHTHALENE IN AIR AND COAL GAS VAPOURS.

An Investigation in the Physical Laboratory of the South Metropolitan Gas Company.

By the courtesy of Mr. Charles Carpenter, D.Sc., we are enabled to publish a particularly interesting record of the results of an investigation on the above subject which has been conducted in the Physical Laboratory of the South Metropolitan Gas Company. To the work the signature of Mr. J. S. G. Thomas is appended. It should be explained that this only deals with the first part of the research that has been undertaken. We are sure it will be hoped by our readers that, when the results of the further prosecution of the research are available, we shall have the opportunity of presenting them to our readers for the general benefit of the industry. The publication of records of work of this kind adds further to the indebtedness of the profession generally to the South Metropolitan Gas Company.

A KNOWLEDGE of the vapour pressure of naphthalene in coal gas is of extreme importance to gas engineers and those concerned with the distribution of coal gas. The amount of naphthalene required to saturate any given volume of gas can be at once calculated from the knowledge of the vapour pressure of naphthalene in the gas.* The method of evaporation for the determination of the vapour pressure of naphthalene presents numerous advantages over the barometric method. This method has been previously employed by R. W. Allen† and by E. Schlumberger.‡

The method, in theory, is extremely simple. It consists merely in passing a known volume of air or other gas over a weighed amount of naphthalene, and determining by difference the amount of naphthalene which evaporates. It is necessary to ensure that the gas passes sufficiently slowly to become saturated. Allen and Schlumberger both employed the evaporation method, and the former attained confirmatory values by the barometric method.

Schlumberger labours under a misapprehension when he states that Allen's values at lower temperatures are extrapolated from the values at higher temperatures. Allen determined the vapour pressure at 15°, 30°, 45°, 60°, and 75° C. by the evaporation method, and at 0°, 39°, 46·8°, 80·4°, 100°, 116°, and 130° C. by the barometric method. Schlumberger confined his experiments to the region of temperature 0° to 50° C. The results obtained by Schlumberger between 0° and 30° differ appreciably from those obtained by Allen over the same range. Above 30° C., the values obtained by both observers agree within the limit of experimental error.

At 0° C., Schlumberger obtained the value 0·006 mm. as the vapour pressure of naphthalene; while Allen's value is 0·022 mm. —a value almost four times as large. Although neither pressure can be regarded as large, the difference in the amounts of naphthalene carried by the quantity of gas manufactured per day by one of our large gas companies, as calculated from the respective results at 0° C., is very considerable. The difference will be appreciated by those concerned with the distribution of coal gas; Allen's value at 0° C. being practically identical with that found by Schlumberger at 10° C.

Owing to the differences existing between the experimental results of these observers, it seemed an essential preliminary to the determination of the vapour pressure of naphthalene in various vapours to redetermine the vapour pressure in air and coal gas, either of which is to be used in succeeding experimental work.

PREPARATION OF THE NAPHTHALENE.

This was prepared from what was described as pure naphthalene. The sample was alternately digested with sulphuric acid and caustic potash several times—being washed with water between each digestion. The purified sample was three times distilled in steam, drained free from water, sublimed, powdered, and set to dry *in vacuo* over concentrated sulphuric acid for about six weeks. The melting point of the sample was 80·2° C.; and when boiled with concentrated sulphuric acid, it gave a very slight coloration.

APPARATUS AND METHOD OF EXPERIMENT.

The method of experiment was similar to that employed by Allen and Schlumberger. A rectangular bath of tinned copper, 2 ft. 9 in. long by 10 in. deep by 6 in. wide, was constructed. The water in the bath was heated by luminous burners; the temperature being regulated by a gas-regulator of the type described and used by Perman.* The regulator was found very efficient over the range of the temperatures employed. The temperature rarely varied more than 0·01° C. during an experiment; and I believe the maximum temperature error in any experiment does not exceed 0·03° C.† The temperature of the water in the bath was indicated by the thermometer T (fig. 1, below), which was standardized under the conditions of use at the National Physical Laboratory. The stem of the thermometer was surrounded by water sucked up from the bath into the tube L; the tube itself being wrapped with a thick layer of cotton wool. Readings of temperature were taken by means of a "reader;" and all temperatures were reduced to the hydrogen scale. The water in the bath was thoroughly stirred by two stirrers S_1 S_2, connected to pulleys P_1 P_2; the pulleys being driven by a small hot-air engine. The stirring was very efficient; and no difference of temperature could be detected when the thermometer was placed at various parts of the bath. No difference of temperature, likewise, could be detected when the water in the tube L was renewed.

The gas employed (air or coal gas) entered through the wash-bottle A containing concentrated sulphuric acid. B is a mercury gauge, inserted to measure the pressure of the gas, and to ascertain that the pressure was not appreciably different from atmospheric. The gas was further dried by passing up the tower C, filled with pumice moistened with sulphuric acid, and over the calcium chloride contained in the U-tube D. Dust was filtered out of the gas by the plug of cotton wool contained in E. The gas then passed through a length of 10 feet of glass tubing (represented diagrammatically at F), so that the gas attained the temperature of the bath. G was a vessel of tinned copper, 10 in. by 6 in. by 1 in., which was closed-down with a lid of tinned copper, fastened down water-tight by screws. A layer of rubber $\frac{1}{4}$-inch thick was placed between the lid and the top of the vessel. The vessel contained the tube H, filled with calcium chloride kept in place by plugs of cotton wool. In G were likewise contained the U-tubes J K filled with naphthalene. The gas was passed successively through H, J, and K.

It is evident that the amount of naphthalene absorbed by the gas (up to complete saturation) at any given temperature depends upon the time the gas is in contact with the naphthalene. This time can be lengthened by employing more tubes containing naphthalene arranged either in parallel or in series, or by aspirating the gas more slowly. In preliminary experiments, it was found that employing three tubes containing naphthalene, the absorption occurring in the third tube at 20°, 30°, and 50° C. was invariably less than could be detected by a balance sensitive to one-tenth of a milligramme when a rate of flow of gas of about 4 litres per hour was maintained. The third U-tube was therefore abandoned, and two tubes J K alone were employed.

The gas after passing through K was passed into the wash-bottle M containing sulphuric acid, where the naphthalene was re-absorbed. The gas then passed into the aspirator, which had a cubical capacity of 36 litres. In most of the experiments a volume of 24 litres of gas was aspirated through the apparatus;

* Ostwald-Luther, "Physico-Chemical Measurements," p. 114.
† Allen, "Journal of the Chemical Society," 1900, pp. 400 to 412.
‡ Schlumberger, "Journal für Gasbeleuchtung," 1912, pp. 1257 to 1259.

* Perman, "Evaporation of Water in a Current of Air," Proceedings of the Royal Society, Vol. LXXII., 1903, p. 74.
† An exception must be made of the case of the measurement at 12·98° C. The bath in this case was kept filled by a current of tap water. The thermostat was not used; and a maximum variation of about 0·3° C. occurred during the course of the experiment.

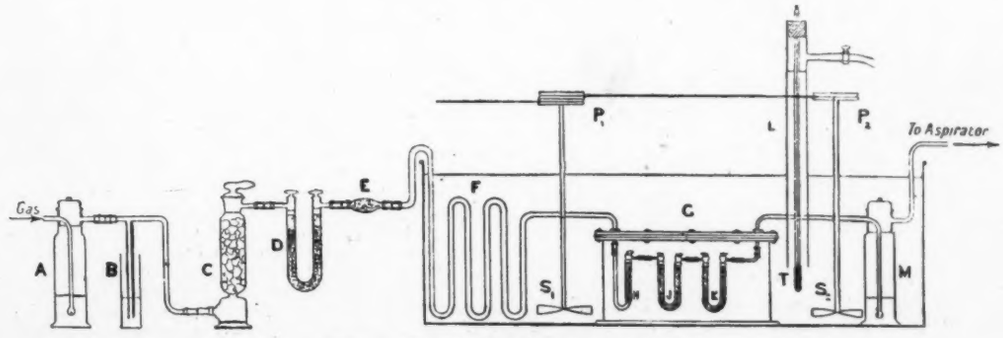


FIG. 1.—THE APPARATUS EMPLOYED.

a larger volume being aspirated at the lower temperature. Thus at 0° C. the volume aspirated was 83 litres. Air at 65° C. was aspirated through the apparatus for three hours before commencing the series of tests.

The volume of gas employed was corrected for: (1) Temperature—all volumes were calculated at a temperature of 15° C. and all temperatures were reduced to the hydrogen scale; (2) humidity—the pressure of water vapour was taken from Kaye and Laby's tables, and the partial pressure of the gas obtained by subtraction from the total pressure; (3) pressure—all volumes were calculated at a pressure of 760 mm. of mercury.

Method of Calculation.

T being the absolute temperature of the gas at which its volume V is dermined, m the molecular weight of naphthalene, g the weight of naphthalene carried by the volume V of gas, the pressure of the naphthalene is given by:

$$p = \frac{62290\, g\, T}{m\, V}$$

In the present experiments $T = 288$ and $m = 128$. Then g was always calculated for a value of $V = 1$ litre of dry gas at 15° C. and 760 mm. pressure.

Results Obtained.

The results obtained are set out in tabular form herewith. The results could always be repeated with an agreement of 2 per cent.; and this accuracy is claimed for the experimental results.

Table I. gives the experimental results obtained; temperatures being corrected to the hydrogen scale.

Table I.

Temperatures. °C.	Vapour Pressure. Air. Millimetre of Mercury.	Vapour Pressure. Coal Gas. Millimetre of Mercury.
0	0·00538	—
12·98	0·0233	—
19·86	0·0500	—
24·80	0·0845	0·0837
29·62	0·128	—
34·60	0·218	0·217
39·70	0·320	—
44·86	0·526	0·534
49·94	0·801	—
59·76	1·780	—

The values obtained when using coal gas are seen to agree with those obtained when the naphthalene evaporates into air.

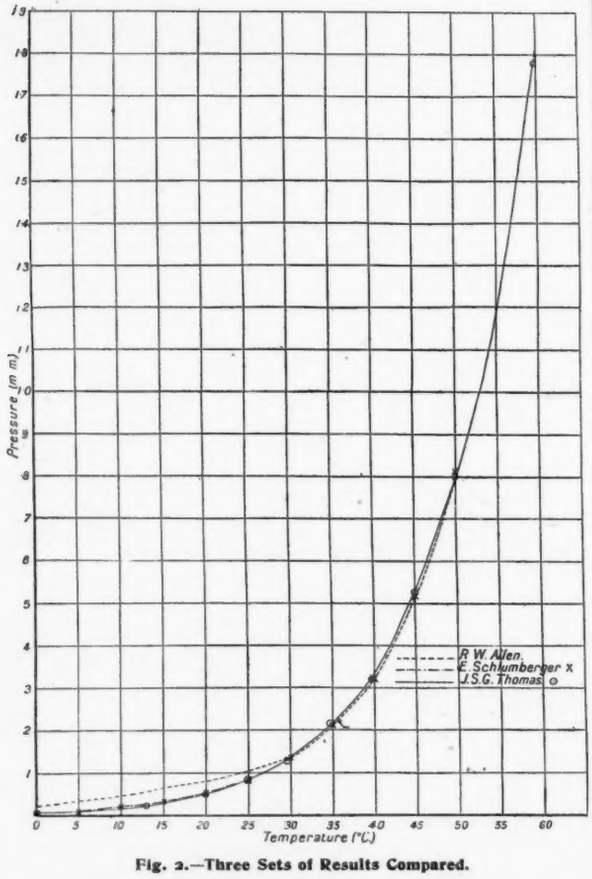


Fig. 2.—Three Sets of Results Compared.

The experimental results are plotted graphically in fig. 2. The results obtained by Allen and Schlumberger are also shown on the same diagram.

Discussion of Results.

A consideration of fig. 2 indicates that at temperatures above 30° C. the observations of Allen, Schlumberger, and the author of the present work are in practical agreement—what little differences exist being probably due to experimental error. This may be gathered from the fact that at 45° C. the value obtained by Schlumberger is less than the value obtained by the present author; the reverse being the case at 50° C. Allen's values, however, are uniformly lower (though very little lower) than the values obtained in the present experiments between 30° and 50° C.

The important parts of the curves relate to observations made at temperatures below 30° C. Here it will be seen the values obtained by Allen are very considerably in excess of the values obtained by Schlumberger and myself; the values obtained by the two latter being in practical agreement. The difference between Allen's values and the values obtained by me cannot be ascribed entirely to experimental error. An examination of Allen's results shows a consistency of about 2 per cent. among individual results at any different temperatures. In seeking an explanation of the discrepancy, three possible causes present themselves.

(1) The possible presence in the naphthalene used by Allen of an impurity more volatile than naphthalene below 30° C. In the series of experiments by the present author, precaution was taken to remove any more volatile impurity by the prior aspiration of air at 65° C. for some hours over the naphthalene.

(2) The possibility that, at temperatures below 30° C., the gas employed did not attain the temperature of the bath. Allen did not heat the gas to the temperature of the bath prior to its entering the naphthalene tube. In Schlumberger's and the present author's experiments, this precaution was taken. To see how far this might influence the results obtained with the present apparatus, experiments were performed at a temperature of about 15° C.; the gas being in the one case preheated and in the other not. The air temperature was 21·7° C. A difference of, roughly, 2 per cent. was obtained; the preheated gas giving the higher result. The possibility of the atmospheric temperature in Auckland, New Zealand, being higher than in London was taken into consideration, by heating the gas to 35° C. by means of a water-jacket prior to its entering the naphthalene tube, which was at about 15° C. In this case likewise the difference found was within 2 per cent. A knowledge of the dimensions of Allen's apparatus would help one to realize more exactly the experimental conditions of his work. It is possible that less time was allowed the gas to attain the temperature of the bath than was the case in the experiments here cited.

(3) A third explanation may consist in the possible polymorphism of the naphthalene at temperatures below 30° C. This explanation was suggested to the author by Professor Henry E. Armstrong, F.R.S.

The experimental results obtained, and given in Table I., can be well co-ordinated by means of a formula of the Kirchoff-Rankine-Dupré type:

$$\log p = A + \frac{B}{\theta} + C \log \theta.$$

Logarithms being taken to base 10, and temperatures θ being expressed on the absolute scale, the values of the constants being determined from the observations by the method of least squares, the observations being weighted according to their proportional accuracy, we find:

$$A = 11{\cdot}7797$$
$$B = -3812{\cdot}34$$
$$C = -0{\cdot}02593$$

So that

$$\log p = 11{\cdot}7797 - \frac{3812{\cdot}34}{\theta} - 0{\cdot}02593 \log \theta.$$

A comparison of experimental and calculated values is given in Table II.; the differences being given in the fourth column.

Table II.

Temperature. °C.	Vapour Pressure (Millimetre of Mercury). Experimental.	Vapour Pressure (Millimetre of Mercury). Calculated.	Difference. Experimental—Calculated.
0	0·0054	0·0056	−0·0002
12·98	0·0233	0·0243	−0·0010
19·86	0·0500	0·0499	+0·0001
24·80	0·0845	0·0820	+0·0025
29·62	0·128	0·131	−0·003
34·60	0·218	0·209	+0·009
39·70	0·320	0·334	−0·014
44·86	0·526	0·527	−0·001
49·94	0·801	0·812	−0·011
59·76	1·78	1·81	−0·03

Table III. gives the value of the vapour pressure of naphthalene between 0° and 60° C. at intervals of 5° C., calculated by the above formula; and in the last column is given the amount of naphthalene in grains to saturate 100 cubic feet of dry coal gas at the various temperatures—the volumes of gas being throughout measured at 15° C. and under a pressure of 760 mm. of mercury.

Fig. 3 is a graphical representation of the results given in the third column of Table III. This is the form in which the experimental results will be of most value to those concerned with the manufacture and distribution of coal gas. Curve A represents the results over the range of temperature 0° to 60° C. Curve B refers to the range 0° to 30° C.; it being possible in this case to choose a very much larger scale of ordinates, in order that from

TABLE III.

Temperature. ° C.	Vapour Pressure. Millimetre.	Grains of Naphthalene to Saturate 100 Cubic Feet of Dry Coal Gas Measured at 15° C. and 760 Millimetres.
0	0·0056	1·75
5	0·0101	3·15
10	0·0176	5·49
15	0·0301	9·39
20	0·0506	15·8
25	0·0836	26·1
30	0 136	42·4
35	0·218	68
40	0·343	107
45	0·533	166
50	0·816	254
55	1·23	383
60	1·84	574

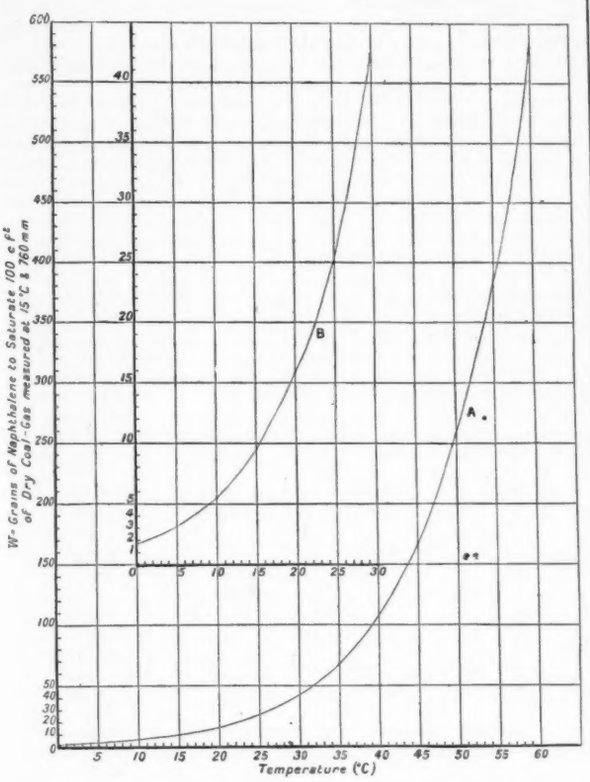


Fig. 3.—Grains of Naphthalene to Saturate Gas under Different Conditions.

Curve B the saturation values can be accurately read over the important range of temperature 0° to 30° C.

The number of grains W required to saturate 100 cubic feet of dry coal gas (measured at 15° C. and 760 mm.) can be calculated at any temperature θ in the range 0° to 60° C. with very considerable accuracy by the formula:

$$\log. W = 14{\cdot}2739 - \frac{3812{\cdot}34}{\theta} - 0{\cdot}02593 \log. \theta.$$

The following method of interpolation by logarithms is sufficiently exact for all practical purposes: The curve giving the relation of W to θ is approximately hyperbolic; so that log. W plotted against θ gives a curve of slight curvature which may, over small intervals, be regarded as a straight line. Log. W may therefore be interpolated by the method of proportional parts—*e.g.*, to find value of W at 12° C. we have:

Temperature.	W.	Log. W.
10° C.	5·49	0·7396
15°	9·39	0·9727

Difference of logarithms for 5° C. = 0·2331
∴ difference for 2° C. = 0·0932
∴ log. $(W)_{12}$° = 0·7396 + 0·0932 = 0·8328
∴ W_{12} = 6·8 grains.

From Curve B, the value 6·8 grains is obtained.

SUMMARY.

(1) The vapour pressure of naphthalene in coal gas and air is determined at various temperatures between 0° and 60° C.

(2) The results are throughout in substantial agreement with the previous observations of E. Schlumberger, but differ at temperatures below 30° C. from the results obtained by R. W. Allen.

(3) An empirical formula of the Kirchhoff-Rankine-Dupré type is found to represent the experimental results very exactly.

THE FRENCH ARRANGEMENTS FOR THE EXTRACTION OF TOLUOL.

A Bill was recently introduced into the French Chamber to provide for the extraction of toluol from coal gas throughout the country; and the following statement was made by the Minister responsible for the drafting of the measure.

Gentlemen,—In time of war, the provision of explosives for each of the belligerent Powers is one of the first steps to victory. Hence the importance of the production of explosives is in the case of every nation linked-up with that nation's resources of raw materials which can be used for this manufacture, and which raw materials only exist in limited quantities. Among these raw materials one of the chief is the industrial product known by the name of benzol, which is composed by the mixture of various atoms of hydrogen, called by the chemical name of aromatic hydrocarbons. Among those which exist in benzol are notably the benzene, which serves, after various successive changes, for the preparation of melinite (picric acid).

The benzol is a product of the distillation of coal which is usually obtained by extraction from the gas which is driven off in coke-ovens; the gas being caught and treated in special apparatus. The ovens which admit of this treatment are known as recovery plants, and only exist in the more modern works. The number of these ovens which are actually working in France, or could be brought into operation during the war, is comparatively small. This source of raw materials is now being used to its very fullest capacity. Aromatic hydrocarbons are to be found equally in certain petroleum products, from which they can only be separated by more complicated methods. But these methods have nevertheless been adopted in this direction, and everything has been done which can be done.

There remains a third source of benzol, which is illuminating gas distributed in towns for heating and lighting purposes. These hydrocarbons are found in the proportion of some 20 grammes per cubic metre, corresponding to about 6 kilogrammes per ton of coal treated. It appears from various reports that Germany has already taken the necessary steps for the treatment of illuminating gas in the principal cities. Certain of our Allies are also doing the same. It is necessary to-day for France to take similar steps; and it is impossible to disregard the large quantity of explosives which she can obtain by using the raw materials thus collected. It seems, however, necessary to have recourse to legislation in order to adopt this process.

It must be noted that the extraction of benzol from the gas will have the effect of depriving the latter of a great part of its illuminating power, though its calorific value will be little reduced (from 1 to 5 per cent.). Gas will, therefore, only be able to be used for lighting purposes by means of incandescent mantles; but as these mantles have been almost universally adopted already, the proposal will, in fact, involve no serious inconvenience to gas users as a whole. The result will be, however, that the gas deprived of its benzol will not have the same qualities as before, and will not comply as a general rule with the terms specified in the contracts entered into between gas users and gas producers. These latter will therefore find it impossible to comply with their obligations; and so the State must relieve them of liability under this head.

In theory, it would no doubt be possible, at any rate in part, to restore its calorific and lighting value to debenzolized gas, by replacing the benzol by mixtures of hydrocarbons obtained by treating petroleum products in a certain manner. This solution does not appear to be applicable to France, where there are no plants sufficiently elaborate to permit of the preparation and distribution of the comparatively great quantities of special spirit which it would be necessary to mix with the debenzolized gas every day to restore its illuminating value. The only way of arriving at a practical statement appears to be the commandeering by the State for military purposes of certain products indispensable for war purposes, and thus to break all contracts relating to the commandeered products. But it will be necessary to indemnify the individuals affected, to the extent of the damage which may be caused to them by this commandeering.

As the Ministry of War has the right of commandeering, it would not have been necessary to obtain legislative sanction had not the question been one of great complication. On the one hand, it does not appear possible to requisition the benzols in the gas without commandeering the gas itself; and such a wholesale requisition, by destroying the existing contracts between municipalities and gas producers, would have far-reaching effects, which would raise all sorts of peculiarly delicate questions, and would involve certain difficulties and possibly regretable delays. Recourse to legislation obviates these difficulties. On the other hand, if legislative sanction is given to the proposed process, this process can be carried out more easily, and will appear more quickly as a step taken solely with the object of meeting the urgent requirements of national defence, and as an expression of the national wishes. By this means, it is possible to proceed very simply. It is sufficient to authorize gas producers to depart from certain clauses in their Statutes; but, of course, solely for the benefit of the State, and solely to meet military requirements.

In addition to the fact that present circumstances are exceptional, and of a kind which justify a departure from existing rights,

the proposed solution only involves a negligible amount of damage to consumers. Owing to illuminating by means of incandescent mantles, the lighting properties of gas itself have lost their importance; and it is only its calorific value which is used. In addition, the expense involved by changing an ordinary burner from a flat-flame to a burner with a mantle is quickly recouped by the saving in the consumption of gas; so that it rests with the consumer to avoid being damaged by the great loss in illuminating power. In this respect, therefore, there is no reason for an indemnity. As far as the reduction in the calorific value of gas used not for lighting but for fuel is concerned, as this reduction involves the consumption of a greater quantity of gas to attain the same amount of heat, this, as a matter of strict right, should be indemnified by a reduction in the price of the gas proportionate to the reduction in calorific value. In fact, as far as each consumer is concerned, the sums involved are extremely small.

If the matter is looked at from an equitable point of view, and by comparison with the burdens imposed on the great majority of citizens by a state of war, one is forced to the conclusion that an indemnity is not justified, as it merely involves granting an indemnity to users of gas owing to the present position of their country. Remember, the price of coal, for example, owing to the war, is more than double. But the price of gas, except in a very few places, has not changed, or has only been raised to a slight extent; and the increase of expense (1 to 5 per cent.) which the proposed law involves for consumers of gas who will be affected, will still leave them in a more favourable position than that of their fellow-citizens who have not already this means of heating available. The arrangements proposed appear, therefore, to be the means best suited in the circumstances to give all manufacturers of explosives new supplies of raw materials which are indispensable at the present time.

Chains and Other Lifting Appliances.

A useful memorandum has been prepared for the Home Office (for official use) by Mr. G. Stevenson Taylor, H.M. Inspector of Factories, on chains and other lifting appliances. It deals with the causes of, and possible means of preventing, accidents arising from the fracture or failure of chains and such metal appliances as rings, hooks, shackles, swivels, &c., used for lifting purposes. Accidents caused by the failure of structural parts of hoists, teagles, and cranes are, it is pointed out, not uncommon; and the prevention of hoist and teagle accidents was dealt with in a report issued some years ago. The memorandum opens with a sketch of existing legislation relating to chains, &c.; and then there is an explanation of different types of appliances alluded to, and the methods of manufacture. A description follows of the kinds and proportions of links, rings, hooks, shackles, eyebolts, and swivels, and the use and wear of chains, slings, and other lifting appliances. The methods of testing, annealing, and examination are set forth clearly and concisely; and reference is made to the procedure of marking and keeping records of lifting gear. Failures of chains due solely to reduction of material by wear are, it is said, uncommon; but a moderate amount of wear reduces the strength of the appliance, and may be a contributory cause of failure. A number of failures of chains, rings, and other welded parts are caused by defective welds, which are due to scale and dirt between the joining surfaces of the weld, welding at a low temperature, or overheating causing burnt and brittle metal. Loss of life, serious personal injury, and damage to machinery and plant have often occurred through defective welds. Unfortunately, it seems that so far no positive method of detecting such welds has been discovered; and the chain user must therefore rely solely upon the careful observation and experience of the chain examiner. This being so, the fact is impressed upon the user that he should encourage frequent and careful examination of all lifting appliances, especially those with welded parts. In connection with another common cause of failure—namely, overloading—a point is mentioned which should be borne in mind. There are many American lifting appliances—such as patent blocks—used in this country. These are often marked with the lifting capacity in U.S. tons of 2000 lbs., and so are overloaded if worked to their full lifting capacity in English tons of 2240 lbs. The amount of useful information contained in the memorandum is in no wise represented by its cost, which is only 6d.

Illuminating Engineering Society.—A meeting will take place at the Society of Arts Rooms on Tuesday, the 11th prox., when a discussion on "Some Principles in Industrial Lighting, with Special Reference to the First Report of the Home Office Departmental Committee on Lighting in Factories and Workshops" will be opened by Mr. J. S. Dow.

Underground Waters in Australia.—Dealing with this subject in one of the recent numbers of the "Scientific Australian," Mr. T. Parker directs attention to the diminished flow of water in many of the artesian wells of New South Wales, Queensland, and South Australia. An inter-state conference which considered the matter heard a good deal of conflicting evidence, but came to the conclusion that the decrease was mainly due to a reduction in the supply of underground water. The opinion is, however, held that it may be due to corrosion causing defective casings in the wells, and by shocks causing breakages and leakage. Mr. Parker advocates a new investigation and a survey of the wells; and he hints that several States will shortly undertake this.

SOME REFLECTIONS ON UNACCOUNTED-FOR GAS.

In a recent issue of "Het Gas," a correspondent writes, Heer G. J. Somer, who is the Manager of a Dutch gas-works, introduced the question of unaccounted-for gas. In Holland, this is a well-known topic; for almost all Dutch gas-works are municipally owned, and so all accounts and reports are considered and passed by the council. It frequently occurs, therefore, that in some town a councillor takes a remarkable interest in the figure of unaccounted-for gas. In one case mentioned by the author, the gas manager was blamed by a councillor for having a loss of 3½ per cent.

The point here is not whether 3½ per cent. is a big figure, but whether there is some connection between the gas production and the unaccounted-for figure. Correctly speaking, there can be no trace of connection between production and loss; but certainly there is the possibility of connection between the measurement of the produced gas and of the gas sold through the meters of private dwellings. One of the "golden rules," to keep the retorts hot, still applies; for with hot retorts there is a good make of gas. But when working with high temperatures, it is quite possible that the cooling is not sufficient to allow of condensation to really normal temperatures; and when the gas-works equipment is of moderate capacity, and the station-meter is placed in a somewhat enclosed space, it goes without saying that the gas produced is measured at a temperature slightly above normal. On the other hand, the delivered gas is distributed through mains in the ground; and for the temperature of the soil one may take an average 4° or 5° C. below normal.

In this way, a difference is arrived at in the temperatures of measurement of 5° or 6° C. in favour of the distributed gas; and as the gaseous contraction for every degree Celsius is $\frac{1}{273}$, it may be calculated that this small difference in temperature results in the fact that consumers' meters register 2 per cent. slower than station-meters. So that 2 per cent. of unaccounted-for gas is due to the difference in temperatures of the two measurements. To provide against this, a correction for temperature would be necessary; but in practical work this is impossible. It is, however, of interest to know that in a perfectly sound distribution system these losses may occur.

But there are also other factors influencing the question. Take, for instance, public lighting. How is the consumption of the street-lamps arrived at in various towns? Have they special meters for this department? Not at all. Looking at the available statistics, it is seen that in one town a figure of 100 litres hourly consumption per lamp is put down; in others it is taken as being 180 litres. Assuming a street-lamp burns 2000 hours a year, and that a town has some 200 lamps, this makes a difference of 1,120,000 cubic feet per annum. Street lighting, too, may have other effects on the figure of unaccounted-for gas, now that automatic lighting is extending in use. For distance lighting of street-lamps, it is necessary that every burner should have a pilot-light. Generally, it is taken for granted that these pilot-lights use only a trifling quantity of gas; and so the gas is not reckoned for. But is it really the case that the consumption of these pilot jets is only trifling?

The author works out the figures for his district, where there are about 150 street-lamps, put down at 120 litres per hour, without regard to the pilot-lights. The burning-time of the lamps is 1750 hours per annum. Taking the hourly consumption of the pilot-jets, as tested, at 10 litres an hour, they consumed 350,000 cubic feet of gas per annum, not paid for, as compared with 1,050,000 cubic feet for the paid-for consumption on the public lighting.

Therefore anyone having distance lighting for his public lamps, does well to bear in mind, not only the paid-for consumption, but also the consumption of the pilots which is not paid for. If this is not done, the pilot consumption is added to the amount of gas lost, thereby making this figure much bigger than it ought to be.

RECOVERING AMMONIA FROM WASTE LIQUOR.

The December issue of the "Journal of Industrial and Engineering Chemistry," contains an article by Mr. E. L. Knoedler, of the Welsbach Company, of Gloucester, N.J., U.S.A., regarding a recent investigation he made of waste products from the Company's plant, which brought to light a solution containing about 1 per cent. of ammonia, which was being discharged into the sewers.

The investigation showed that the solution consisted of a mixture of three ammoniacal solutions containing, respectively, the following percentages of free and combined ammonia:

No.	Per Cent. Free NH_3.		Per Cent. Combined NH_3.
1	3·5	..	0·170
2	0·5	..	0·025
3	0·1	..	0·005

When mixed together, as they appeared when run to waste, the mixture approximated 1 per cent. of free ammonia and 0·05 per cent. of combined ammonia. The solution was perfectly clear, and recovery of the ammonia was found to be practicable by the usual methods of distillation.

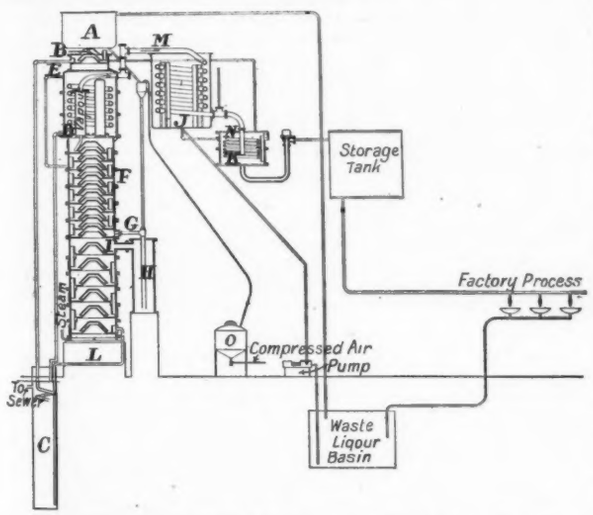
The waste liquor was produced by the factory processes at

practically a constant rate throughout the working day; and this consideration influenced the decision to recover by means of a continuous still. In the selection and erection of the apparatus, the points of easy and inexpensive maintenance and operation were carefully considered, with special attention to low labour charges and small steam consumption.

With these points in mind the distilling outfit was so erected and set that the waste liquor flowed by gravity from the factory processes to a large iron tank set in the ground just outside the still-house, from which it is pumped to the storage tank set above the column of the still. This pumping is the only handling of any liquor during the complete cycle of operations—the storage tank supplying the liquid at a constant head at all times, whence it flows by gravity through the washer, the coils of the heat exchanger, the heater, and the still—the waste passing around the coils of the heat exchanger and then to the sewer. The ammonia vapours pass through the condenser and into the absorber, from which the freshly-distilled ammonia overflows into the storage tank, which is set at such a height that the fresh solution flows by gravity to the factory, where it is available for use by simply opening a cock.

The steam supply for the still is automatically controlled, as is also the delivery of lime for the release of the fixed ammonia, so that it is necessary for the attendant to look in only once each hour or two in order to see that the still is operating satisfactorily. The bulk of the heat in the waste liquor is saved by preheating the crude liquor in a heat-exchanger and seal pot—the latter acting also as a constant-flow automatic valve for the release of the waste. The consumption of lime is reduced to a minimum by keeping the milk of lime constantly and thoroughly stirred, and delivering it in small quantities, and at frequent and regular intervals.

By these provisions for automatic operation, the cost of attendance and the handling of liquor, lime, &c., have been reduced to a minimum; the only still charges of any consequence being interest and depreciation, and coal for steam.



The operation of the still is extremely simple. The weak liquor is pumped to the storage tank A by means of a small steam-pump, the exhaust of which is led into the still to decrease the steam consumption. The liquor then flows by gravity at a constant rate, down through the washer B, and then through the coils of the heat-exchanger C, back up through the heater D, where it overflows through the pipe E into the volatile still F, where the free ammonia is driven off. The liquor then passes out through the pipe G into the lime-leg H, where it meets, and is thoroughly mixed with, the milk of lime, when it passes back into the still for fixed ammonia I. Here the fixed ammonia is released, and the waste liquor passes down and out around the coils of the heat-exchanger by the pipe L, and overflows to the sewer.

The ammonia vapour passes up through the still, bubbling through the down-coming liquors in its passage from one section to the next, and then passes out through the coils in the heater D and over into the condenser J by the lead pipe M. Here the water vapours are condensed; and a part of the ammonia is absorbed. The condensate then flows down into the absorber K, where it is kept cool by means of water flowing through the coil N. Here the balance of the ammonia vapours are absorbed; and the resulting ammonia solution passes over into the storage tank, from which it flows by gravity through lead pipes to the factory where it is used.

The milk of lime is made up and kept in an iron stirring tank O, where it is agitated continuously by means of compressed air, which also operates the automatic valve, through which the lime is delivered to the still. The timing of this valve is regulated by a needle-valve and bye-pass between the top and bottom of a cylinder filled with kerosene, in which a piston descends and ascends. This makes it possible to supply the lime in small quantities and at frequent and regular intervals—making for uniform temperatures and regular operation.

Steam is supplied to the still through an automatic valve also operated by compressed air; the controller consisting of a thermostat, depending for its operation on the expansion or contraction of a liquid. The pressure thus generated serves to operate a small air-valve, which, in turn, controls the compressed-air supply to a diaphragm valve through which steam is served to the still. The thermostat is adjusted to operate at the temperature of the top of the still, and serves to keep this temperature within a range of 2° Fahr. of the predetermined point. The concentrate runs about 28 per cent. NH_3 at all times, and is diluted to the desired degree as used.

The cost of operation per ten-hour day runs approximately as follows:

Steam, 12,000 lbs.	$3.00
Labour and supervision	1.23
Lime	0.20
Repairs, paint, oil, waste, &c.	0.35
Interest and depreciation	1.93
	$6.71
Output, 3000 lbs. of 26 per cent., NH_4OH	
Cost per 1000 lbs. of 26 per cent. NH_4OH	$2.24

The outfit has proved to be simple in construction and easy to operate, and the results more than come up to expectations.

POWER PLANT IN FACTORIES.

Before a well-attended meeting of the Junior Institution of Engineers, on Monday evening of last week, Mr. W. A. Tookey (the Chairman) read a lengthy paper on the subject of the "Modernization of Power Plant in Factories."

As justifying his choice of this subject, he remarked that in the more or less immediate future there will undoubtedly be much work for the engineering profession arising from the establishment of new industries in the country, and also from the modernization of factories that have been in existence since a generation or so ago. He did not devote attention to matters pertaining to the planning or equipment of new factories, but to some of the more important details that have to be considered and determined in connection with the modernization of existing concerns. As he remarked, in a new undertaking the co-ordination of power generation and transmission, and of heating, lighting, and ventilating systems may be comprehensively studied; and at the same time each separate requirement can be considered, and such a decision be come to as shall ensure the highest all-round efficiency being eventually secured. In the conversion of existing systems in factories already established and in operation, on the other hand, not only do the same matters have to be considered just as fully, but due regard must also be given to the relative importance of various conflicting issues. Speaking generally, he said that it must be admitted that in many factories throughout the country a large amount of wastage goes on from day to day, which prevents the old-established concerns from competing effectively in the open market with the undertakings that have been started in recent years in Great Britain, Germany, or the United States. The wastage which goes on in factories that cannot be classified as modern does not necessarily imply either lack of knowledge of what other people are doing in the same industry or lack of any spirit of progressiveness. Mainly it is the result of undue caution in the spending of capital. Much of the inefficiency that can be noted in old-established factories can be attributed to the purchase of unsuitable apparatus, as a result of parsimony induced by the desire of proprietors to limit to a minimum their outlay on tools and appliances.

Gas for Power.

Considering what would be the best form of power plant to instal for all-round results, in connection with particular trades, Mr. Tookey first referred to what would be the ideal conditions from the point of view of maximum efficiency. These, he said, would include continuous working over long periods, as also the utilization of various products resulting from coal carbonization, which are entirely destroyed in the usual practice of steam and gas generation. This, however, implies that the plant shall be of such capacity that the cost of recovery of otherwise waste products would be commercially worth doing. It also involves a reasonably high load factor, and the distribution of power so produced either in the form of gas or electricity, and thereby further assumes that the plant will be placed in such a locality as will allow of transmission being efficiently provided for, and the entire output be sold at remunerative prices.

While admitting that such conditions as these cannot be universally met with, he pointed out that in some cases the ideal has been closely approached. Gas undertakings extract the utmost value of the residuals in the carbonization of coal; and, said Mr. Tookey, "every day sees progress being made in the many problems that are presented to the engineers specially engaged in this branch of engineering science. It is unfortunate, however, that, despite all that has yet been done, the price at which the gas thus manufactured can be distributed is such that, speaking generally, only for comparatively low-power engines is its use commercially profitable." Other instances cited were the distribution in South Staffordshire of low-grade power gas suitable for engines and for furnace work, a central gas-power electricity works in the

North, the installation of bye-product coking-ovens, and the utilization of blast-furnace gases.

The author went on to remark that the competition which exists between gas and electric undertakings for the supply of motive power for factories in large towns is particularly keen; and it is therefore important to realize the relative costs upon a truly comparable basis. In the case of an electric motor, there are several outstanding advantages, when compared with a gas-engine; but usually the cheaper operating cost of the latter makes it preferable for purely commercial reasons. Considering in detail the working costs, the author, referring first to gas-engines, dealt with the question of compression pressure, the falling off of thermal efficiency with reduction of this pressure, and the loss due to friction. Summing up the calculations, he said the following figures would give a good idea of the actual efficiencies reached by a gas-engine at various loads, and would indicate the gas consumption thereby entailed on the basis of cubic feet per brake horse power, assuming that the gas had a calorific value of 500 B.Th.U. per cubic foot.

—	Compression Pressure, Pounds per Sq. Inch.				
	50	80	100	120	160
FULL LOAD.					
Mechanical efficiency . . .	·81	·84	·85	·86	·864
Cubic feet per B.H.P. hour (500 B.Th.U. gas.)	31·5	21·7	19·3	17·65	16·45
THREE QUARTER LOAD.					
Mechanical efficiency . . .	·76	·80	·81	·82	·83
Cubic feet per B.H.P. hour	33·5	22·7	20·2	18 5	17·1
HALF LOAD.					
Mechanical efficiency . . .	·675	·73	·74	·75	·76
Cubic feet per B.H.P. hour	37·5	24·9	22·2	19·75	18·7
QUARTER LOAD.					
Mechanical efficiency . . .	·51	·58	·60	·61	·62
Cubic feet per B.H.P. hour	50·0	31·5	27·3	25·0	22·9

Probably, Mr. Tookey added, the majority of gas-engines may be considered as working at a mean load equivalent to five-eighths of the maximum; and the table shows that, according to the age of the engine, as indicated by the variation in compression pressure, the gas consumption will vary from about 35 to 18 cubic feet per B.H.P. hour. Assuming that a compression pressure of 120 lbs. applies to the larger number of engines that are at present in operation, then, for comparable figures with regard to electric motors, it might be taken that the average engine demands (say) 19 cubic feet of 500 B.Th.U. gas per B.H.P. hour. Thus if the average price of town gas to power consumers be taken as 1s. 8d. per 1000 cubic feet, generating 1 B.H.P. hour would cost 0·38d.

ELECTRIC MOTORS.

As regards electric motors, continued the author, the estimation of the rate of current consumption is a much simpler matter. The efficiency varies according to the size; being higher in large machines than in small. While the larger machines will give out as power 90 per cent. of the current applied to the terminals at full load, 88 per cent. at three-quarter, 84·5 per cent. at half, and 74 per cent. at quarter load, smaller ones will yield (say) 85 per cent. at full load, 84 per cent. at three-quarter, 79 per cent. at half, and 70 per cent. at quarter load. Adopting the mean of these figures, the following table shows the approximate current consumption of average motors at various outputs per B.H.P. hour.

	Full Load.	Three-Quarter Load.	Half Load.	Quarter Load.
Motor efficiency average . .	·875	·86	·82	·72
Equivalent to units per B.H.P. hour	·852	·868	·91	1·035

Assuming, said Mr. Tookey, as in the case of the gas-engine, that the normal factory load would approximate to the equivalent of five-eighths of the full-load output, it will be seen that somewhere about 0·89 unit would be consumed per B.H.P. hour; and therefore for similar working costs this should be procurable for the same price as 19 cubic feet of gas, or, upon the assumption of cost already made, gas at 1s. 8d. per 1000 cubic feet would be equivalent to electricity at 0·427d. per unit. In other words, electric current at 1d. per unit may be taken as equivalent to gas at 3s. 10d. per 1000 cubic feet. Having said this much, the author added that, notwithstanding this vast difference in favour of the small gas-engine served by town gas over small electric motors, there are many conditions under which the latter would preferably be installed; and these he enumerated. When, however (he proceeded), the load upon the engine or motor is fairly regular and continuous, it would be evident from the figures given that there is so great a difference in running costs that town-gas engines, in spite of the greater space required and the more constant attention needed to keep them in the best condition, offer very considerable advantages to small factory owners. In a pamphlet recently issued by the South Metropolitan Gas Company, with reference to installations of gas power replacing electric motors, this fact is deposed to by actual users; and Mr. Tookey declared that a number of these cases are personally known to him.

SUCTION-GAS PLANTS.

Some attention was given to the cost of operating suction-gas engines and producers, in regard to which it was said that, from a large number of plants of this type, operated under every-day working conditions, and including all wastage due to stand-by losses and utilizable portions of fuel supplied, it may be taken that about 2 lbs. of anthracite are required to generate the equivalent of an electric unit of energy. Referring only to fuel cost, and calculating on this basis, electricity at 1d. per unit would be equal to anthracite at 56s. per ton. Including other items, experience shows that the average cost of generating a unit of electricity by this means does not, with anthracite at 34s. per ton, fall far short of 0·75d., when overhead charges are also taken into account. In rough figures, therefore, while the cost of fuel is only about 0·375d. per unit, the other expenses usually amount to nearly as much again.

INSTALLATION COSTS.

A chart was included in the paper, showing comparative installation costs of town gas, suction gas, and electricity power plants; but it was pointed out that this could only be taken as a general guide, as so much depends upon local circumstances. However, the effect of the chart was to demonstrate that, for true comparisons, the interest upon the additional capital involved in the case of gas-engines should be set off in favour of the electric motor. It was shown, for instance, that, for 20 H.P., while a motor fixed would cost about £60, the outlay on a gas-engine of equal output would be nearly double, while a suction-gas engine and producer would cost nearly three-and-a-half times as much. Therefore the town-gas engine should be debited with £6 per annum as additional standing charges to cover higher depreciation and interest, and the suction plant with an additional £15. This, remarked the author, is tantamount to saying that much depends upon the average or mean load that will prevail during the period of work, and whether the amount likely to be saved by the more economical plant will, in fact, result in an actual saving of money, all things considered. Among the other important considerations to which careful attention must also be given, the amount of power required upon more or less rare cases of emergency must be taken into account; for, while the maximum power of a gas-engine is inelastic, an electric motor can deal with overloads for short or long periods without distress.

OTHER MATTERS.

In subsequent sections of the paper, power transmission was discussed, and reference was made to the cases in which for one reason or another steam would be desirable for power and other purposes. Some remarks followed on assessment for income-tax; the desirability being urged of making allowances from taxation in respect of money spent on factory improvements, &c., and of the abolition of the "three years' average" clause. As to depreciation allowances, it was said that, instead of these being based upon an arbitrary yearly percentage on estimated values, account should be taken of the amount of work actually performed by the tool or piece of apparatus. In conclusion, a table was given indicating the power absorbed by shafting in small factories.

Many of the points raised by Mr. Tookey were touched upon by the speakers in the discussion. Some of the members and visitors who contributed to this portion of the proceedings, expressed the opinion that the author, in spite of his long and intimate connection with the internal combustion engine, had shown no bias whatever in his paper; while, on the other hand, one, at least, declared that he perceived indications of a leaning to one side. That those present had spent a profitable evening, was evident from the cordiality with which they accorded Mr. Tookey a vote of thanks for his paper.

MEASURING A VENTURI TUBE DISCHARGE THROUGH A DIRECT-READING METER.

In the "Comptes Rendus," No. 16, Vol. CLXI., M. Dejust described the method he proposed for this purpose. It consists in replacing the usual apparatus for measuring, with an ordinary meter, the pressure difference between the full and the contracted sections of the tube and the integrating mechanism. The difference in pressure between the large and small sections of the tube causes a discharge between these two points. The intake of the meter is directly connected to the full up-stream section of the tube; and between the outlet and the down-stream contracted section of the tube a diaphragm is introduced.

The algebraic expression of the ratio of the discharge through the tube to that through the bye-pass containing the meter shows that this ratio is not constant. By adjusting the section of the bye-pass tube and its diaphragm, however, the terms which are not constant can be reduced to a negligible value, and the ratio made substantially constant for various rates of discharge. The constancy of this ratio has been tested on a line 100 mm. in diameter, provided with a Venturi tube having a contraction of 16 to 1, with a bye-pass 20 mm. in diameter, a meter orifice of 12 mm., and a diaphragm calculated to make the ratio of meter discharge to flow through the line, 1 to 100. By varying the velocity in the line from 0·16 metre to 1·23 metres, the ratio varied from 103·82 to 105·53—that is to say, 1·65 per cent. of the smaller number. Reckoning from the mean of these two values, 104·675, the maximum error will be 0·82 per cent. of the true discharge.

TAR OILS OF VARIOUS GRADES IN RELATION TO THE PRODUCTION OF COMMERCIALLY IMPORTANT DYES.

In continuation of several recent papers in the "Journal des Usines à Gaz," on the value of tar oils to the chemical industry, Professor Mailhe, of Toulouse, in a further contribution to our contemporary, passes in review the dyes of chief commercial importance obtained from the various grades of tar oils. The subject-matter of his paper is, of course, generally familiar to makers of synthetic colouring matters, although less a subject of everyday knowledge among distillers of coal. Hence the portion of the paper which succinctly sets forth the character of the dyes chiefly obtained from light, medium, and heavy tar oils may be usefully translated as a supplement to the abstract of Professor Mailhe's previous remarks published in the "JOURNAL" for the 14th inst. (p. 597).

Light oil—viz., that distilling at temperatures from 50° to 180° C.—while consisting chiefly of aromatic hydrocarbons, such as benzene, toluene, xylene, and cumene, contains also fatty hydrocarbons (pentane, hexane, &c.), unsaturated hydrocarbons, such as hexene, and pyridine bases. The last-named are present in fairly considerable quantity, and are recovered by treatment with sulphuric acid, followed by liberation of the base itself with ammonia. Their importance lies in the value of pyridine as a material for the purification of anthracene, since they yield anthracene of 82 per cent. purity, as compared with 50 per cent. by the use of other solvents.

By treating the light oils with sulphuric acid, unsaturated and basic compounds are removed, after which rectification with soda yields the various aromatic hydrocarbons, which are the starting points for numerous colouring matters. The chief operations are the production of aniline by conversion of benzene into nitrobenzene and reduction of the latter to aniline. In like manner, toluene yields a mixture of from 60 to 70 per cent. of ortho-nitrotoluene and from 30 to 40 per cent. of para-nitro-toluene, similarly converted into ortho and para toluidine. These bases form the indispensable materials for the production of whole series of dyes, one of the most important of which, from the industrial standpoint, is that of the azo dyes, discovered in 1864 and possessing the several advantages of simplicity in manufacture, low cost of production, and great variety of shades. The formation of the colouring matters takes place in the cold; and practically any substance having an amido (NH_2) group in its constitution can be used for the purpose of varying the series. Hence the enormous number of azo dyes—to a total which must be reckoned in thousands. Certain of these azo dyes may be made so cheaply (some are sold at 2 frs. per kilo) that many will long continue on the market.

Next, perhaps, in importance come the tri-phenyl-methane dyes—*e.g.*, fuchsine—obtained by the oxidation of a mixture of aniline and ortho and para toluidine. The series allows of colouring matters from red, through violet and green to blue, being readily prepared. The success of these dyes is still far from having reached its limit. By fusion of para-toluidine with sulphur, the thiazol series of dyes results, the most notable member of which is primuline.

The above large series represent dyes prepared from mono-nitro derivatives of benzene. The di-nitro compounds, reducible to phenylene diamines, are the starting points of still other series. Thus are formed the indamines, by oxidizing a mixture of paradiamine and aniline of the indophenols, in the preparation of which a phenol is mixed with the para-diamine. Similarly the thiazine dyes, including methylene blue, start from the diamines, as do also the euphrodines and saffranines. In all these and other series of dyes, aniline and toluidine play a predominant part. Germany in 1913 exported colours derived from aniline and its homologues amounting to nearly 64.300,000 kilos, representing a value of 180,000,000 frs.

Equally the medium tar oils, distilling at temperatures between 180° and 250° C., are found to possess great importance to the dye-maker from their content, first, of phenol and cresol bodies and, second, of naphthalene. Of these, the phenols and cresols occupy a quite secondary place; their value lying in their linkage with other compounds as in the making of azo dyes. The comparatively few colouring matters which have been introduced, prepared directly from phenol bodies, have not been of any practical value save for certain phthalein dyes. Rosalic acid, a purely phenol dye, is used in colouring paper.

On the other hand, naphthalene and its derivatives, forming the most abundant hydrocarbon of tar oils, by its chemical transformations gives rise to numerous and important series of dyes. Naphthalene is readily converted by strong or fuming sulphuric acid into mono, di- or tri- sulphonate, which acid compounds, on treatment with potash, are converted into naphthols or sulphonaphthols. These naphthols themselves are sulphonated with strong sulphuric acid, yielding acids which form the raw materials for the manufacture of the important Ponceau and Bordeaux colours.

The α napthol is used in the preparation of the only indophenol of which use is made on the industrial scale—namely, in admixture with indigo. Other dyes derived from naphthols by the action of nitric or nitrous acid, are Martius yellow, acid yellow, and gambine G and gambine R. Similarly, reduction of nitronaphthalenes yields naphthylamine bodies which, like aniline, give rise to important and varied series of azo dyes. Altogether naphthalene dyes, while not nearly equal in importance to those from aniline, nevertheless represented an export from Germany in the year 1913 amounting to 3000 tonnes, of the value of nearly 4,000,000 frs.

In the heavy oils, distilling from about 250° to 420° C., the hydrocarbon of importance to the dye maker is anthracene—the crude product containing about 30 per cent. of pure anthracene. By oxidation, anthracene yields anthraquinone, the starting point of the valuable alizarine dyes, which, though requiring a mordant, are yet widely used on account of the great resistance of the colours to soap and light, and the fine depth of the shades which they afford. Exact figures are not available; but it is known the quantity exported from Germany in the year 1913 was 5000 tonnes, representing a value of 15,000,000 frs.

In the above brief sketch, as Professor Mailhe points out, mention has been made only of dyes which are of the greatest industrial importance. It would have been possible to extend the list in many directions without going outside the wide field of colouring matters which are obtained from the raw materials in coal-tar oils. Professor Mailhe briefly refers to the hopes now being entertained in France of engaging in the commercial battle with Germany in supplying colouring matters. He recognizes, as the first step in this endeavour, the provision of preliminary organization for the purpose of producing practical chemists and directing them along lines which have too long been disregarded.

IMPORTANCE OF FLUES IN THE FIXING OF GAS-FIRES.

By H. H. CREASEY.

[From the "Bulletin" of the British Commercial Gas Association.]

This article is intended as a note of warning to those outdoor representatives of gas undertakings who may not have had the opportunity of closely following the development of gas-heating stoves during (say) the past twenty years or so, and also to draw attention to the fact that builders, gas-fitters, and other workmen not connected with gas undertakings may be—and, indeed, in some cases are—fixing gas-fires in an unhygienic manner.

I do not claim to know all there is to know about gas heating and its past and future possibilities—indeed, who among us would be so rash as to make such a claim?—but having first been employed in fixing gas-fires twenty-five years ago by the undertaking which I still have the honour to serve, and having been specially engaged during the last eight years in endeavouring to assist in overcoming the far too prevalent and, in the past, all too well deserved prejudice against gas heating, I trust I shall not be considered as having rushed into print without some little knowledge of the subject under consideration.

ERRORS OF THE OLD GAS-FIRE.

Let us first briefly run over the development of the portable gas-fire, from the past "horror" to the present efficient, hygienic, and beautiful production, which is the result of knowledge and experience bought in that best of all schools, the school of adversity, coupled with many scientific experiments and the exhaustive tests to which all matters pertaining to gas-stoves are now subjected before the finished article is permitted to be presented to the public.

We will go no farther back than the old solid, or almost solid, lump ball-fuel fires, with balls of fire-clay indiscriminately pitched on to the bunsen flames, breaking their cones and causing imperfect combustion. These fires frequently had coloured tiles designed to match nothing on earth—except, it may be, a nightmare produced by a heavy supper—and as they were very deep, they always looked clumsy and stood too far forward on the hearth. In addition to these faults, the products of combustion were offered every inducement not to go up the chimney too rapidly, as the idea then prevalent was that valuable heat would thereby be lost. In order also to deliver as much heat into the room as possible, there were air-heating chambers in the upper parts of the fires, which chambers, as we all know, became dust-traps from which, when the fire was hot, a fine assortment of baked germs arose; and these, with convected heat at a harmfully high temperature, were delivered into the room.

The flue outlets of these fires were always circular, and, as a result, the products of combustion from a burner, covering a front of (say) 12 inches in width, had to crowd together above the top of the fire-clay balls in order to struggle through an opening only about 3 inches in width. Needless to say, they did not all struggle through. In addition to this, the fires sometimes contained devices such as flaps, which, when the customer could be induced to take the trouble to carry out this action, were to be opened or shut, in order to get rather less or more products than usual into the room; there were obstructions in the gas-fire canopies; the canopies were very small or almost non-existent; the flue-elbows were frequently made in grotesque shapes—usually, be it noted, being reduced to a smaller area at their outlets, in order that too much heat (or, in other words, products of combustion) should not be lost.

I know of a fire whose especially good (?) point was that the

products of combustion, before being allowed to get away into the chimney, had to pass through a series of tortuous channels, whose existence was indicated to the customer by a printed design of the interior portion of the stove with arrows showing the way the products ought to go if they behaved themselves. Needless to say, the products usually lost their way, and, taking the line of least resistance, found themselves back in the room. All this in the endeavour to lose as little heat as possible!

Practically coincident with these fires there were those highly efficient metal fret fires, which, owing to the pursuit of the ideal of small heat losses, contained all the same faults as the ball fuel fires as regards the retardation of the products.

A New Era.

A stove, indeed one or two stoves, suddenly came on the market which were made shallower than usual, and of a better and plainer design. The fire-clay balls had disappeared, and their places were taken by a series of upright radiants, in order that the bunsen flames should not be broken. A bolder canopy and somewhat better flue outlet were also provided. I remember quite a number of experts questioning the loss of heat by such fires; and I also remember that I started fixing them in preference to any others because I knew they were on the right lines.

Improvements in Design and Flue Outlets.

Since then developments have come thick and fast; and we now have beautiful designs to suit all kinds of decorations and styles of furnishing—fires of absolutely plain design for those who prefer them, and, perhaps above all, fires which have bold canopies and wide oval flue outlets from which the products of combustion can pour out like water over a smooth waterfall, instead of, as in the past, being required to gurgle out like water from the constricted narrow neck of a bottle.

To come to my point, the stove manufacturers have now succeeded in constructing stoves that, unaided by flue-pipes, are capable of carrying off, or passing away from themselves, all the products of combustion of the greatest number of cubic feet of gas per hour which are ever likely to be consumed by them. To any that now remain doubtful of the hygienic efficiency of gas-fires, we are able therefore to offer scientific tests as proofs of our statements.

The Perfect Modern Gas-Fire.

The stove manufacturers can now claim that they have succeeded in producing what may be looked upon as practically the perfect gas-fire. I mean perfect from the point of view of hygienically giving out as radiant heat, and a very small amount of convected heat, the utmost efficiency that it is wise and expedient to extract from a gas-fire, making due allowance for the fact that a proportion of the total available heat must be used, not wasted, in assisting the ventilation of the room and effectively removing the products of combustion.

The Question of the Flue-Pipe.

Having carried out all the above-mentioned improvements, I am afraid the gas-stove manufacturers are somewhat encroaching on the preserves of us, the outdoor representatives, who have to fix the fires. By this I mean that there is a tendency on their part almost to recommend that their fires—because they are capable of dealing with, or passing from them, all the products of combustion—should be fixed without a flue-pipe. This is where they and I must part company.

I have no hesitation in saying that no gas-fire should be fixed to the average chimney without a short length of flue-pipe securely attached to it; and I have also no hesitation in saying that, owing to the tendency I have just mentioned, a number of gas-fires were fixed without flue-pipes last season. This probably more especially applies to work carried out by builders, gas-fitters, and other workmen not employed by gas undertakings; but the result will be no less harmful on this account.

Dealing with the Products of Combustion.

It is admitted that the modern gas-fire will do all that the manufacturers claim for it; but they do not seem to consider that what is of vital importance is where the fires deliver their products. Because a gas-fire is capable of passing away all its products of combustion unaided, should I be right in standing it in the centre of a room without a flue-pipe? Of course not. Therefore, the point is: Where are these products to be delivered in order that the fire shall be as hygienic in use as it is hygienic in construction? Unless the products are delivered into the chimney proper, I claim that a gas-fire that may be hygienic in construction is not hygienically fixed. As there are so many things that may hinder the products getting into the chimney proper, it is always advisable to fix a flue—say, at least 18 inches in length—to the gas-fire flue outlet in order to ensure that they do so without question or doubt.

The flue outlet of the average gas-fire, if stood back against the average modern coal-grate, will either discharge against the sloping back brick, or will partly discharge against the coal-grate canopy. The products in such cases are beaten back, especially if the rake or angle at which they leave the gas-fire is not quite true with the angle of the opening up which they are to pass. Even assuming they get easily past these possible obstructions, they may still be partially obstructed by the brick projection usually found above the coal-grate canopy, known as the breast or arch bar, or there may be the iron frame of a register to negotiate, and so on.

The result of all this is that the products are either beaten back before they have even had a chance to get away, and accordingly return through the gas-fire canopy—making this certainly not a ventilator, unless "ventilating" inwards is aimed at!—or else they do partly get away; but a proportion, instead of getting into the chimney proper, hang about in the canopy area, or at the back of the stove, and eventually find their way into the room, either from the sides of the gas-fire, the leaky sides of the coal-grate canopy, or the leaky top rib of the coal-grate canopy. I have fixed a good number of fires and have dealt with numerous difficult cases; and I am confident my statements are correct.

I will go further and say that if gas-fires are not fixed with short flues, leading the products direct into the chimney proper above the canopy area, we shall be taking a step backwards, and all the good work that has been done to popularize gas heating [because it can be made to be convenient as well as cleanly, and hygienic as well as economical] will have been wasted, and opportunities will be given for scientists, our customers, and our opponents to claim that gas-fires still smell and are not hygienic. The effect of this might not be immediately or directly noticeable; but the unfailing result would be a check to the recent triumphant march of gas heating, as many customers with a good sense of smell or hypersensitive nostrils would not have gas-fires fixed in their houses, and would spread the bad, instead of the good, word among other possible customers, who, if they used gas-fires at all, would do so to an extent that would be limited by the demands of necessity and not, as we wish, those of inclination and desire. Moreover, as we claim that gas-fires are ventilators—and justly so, if they are properly fixed—let us always make them so, and not be satisfied with fixing in such a manner as to just allow the products to struggle away up the chimney, or even perhaps not quite to do so.

Exceptional Cases.

I quite understand that all my remarks must be qualified in the case of excessive updraughts, when it may be possible to do without a flue at all, or it may be necessary to fix a reducing flue as a check, or in the case of a downdraught, when special measures must be taken according to the circumstances. They probably do not apply also in the case of built-in grates fixed to chimneys of average draught. They principally apply to the ordinary portable fire fixed to a chimney of average or sluggish draught, and especially when fixed to a modern slow-combustion grate, an old-fashioned metal grate with a rounded top, or a register grate, which register may get shut, or partly shut, or obstructed by brick rubbish after the gas-fire has been fixed.

I hope I shall be forgiven for writing so strongly on this point, because there are, of course, thousands of representatives who, like myself, could not be induced to make a practice of fixing gas-fires without flue-pipes; but in case any might be lulled into a sense of security by the perfection of the modern gas-fire, and thereby induced to abandon the general use of flue-pipes, or to condone such an offence when committed by others, I thought it in the best interests of the future of the gas industry to write this article, as damage might be done in the next few years that would probably take several years to put right. Let us beware of putting the clock back and falling into our old errors.

Gas for a Rust-Proofing Process.—In the process worked by the British Bontempi Rust-Proofing Company at Deptford, cast iron, wrought iron, and steel are oxidized by being placed in an air-tight muffle previously heated by gas-jets. Superheated steam is admitted into the muffle; and after about half-an-hour of this treatment, the steam is shut off, and a chemical substance in the form of a powder is placed in a separate retort also heated by gas. The fumes from the chemical powder then enter the muffle under pressure, and give the material being treated a protective coating of oxide. Dipping in oil while still hot, changes the light grey colour of the metal to a blue-black.

Illuminating Engineering Society.—Professor J. T. Morris delivered a lecture, to introduce a discussion, at the last meeting of the Society (at the Society of Arts rooms), on "Recent Developments in Electric Incandescent Lamps in Relation to Illuminating Engineering," in the course of which he traced the gradual development of intrinsic brilliancy of the source of light from the carbon lamps to the gas-filled or "half-watt," and hermetically enclosed tungsten arc. In the course of his remarks, he referred to the "enclosing area" of a light-giving source—*i.e.*, the area enclosed by a line passing round the outer boundary of the light-giving source—and pointed out that, as the field of the light-source is reduced in area, so greater opportunity offers for designing reflectors or shades to give any desired distribution of illumination. On the other hand, greater care is required in placing the reflector in its correct position with respect to the source of light. With this greater concentration of light comes the imperative need of screening or otherwise reducing the effect of the direct light falling upon the eye. These improvements, he said, call for even closer co-operation between lamp and shade manufacturers. Various forms of lamps were shown, including the hermetically sealed tungsten arc in operation. The source of light in this lamp is concentrated to such an extent that it can be used with excellent effect for projection purposes. Examples were also given of special arrangements of lighting.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Origin of the Sliding-Scale.

SIR,—It seems desirable, having regard to the many points that have been raised and suggestions of origination in this matter, that I should state (what I have a clear recollection of) the facts leading to the insertion in the Act of 1875 of the Commercial Gas Company of the sliding-scale clauses in the form in which, with more or less modification, the provisions are now known as sliding-scale clauses.

The provisions that existed before 1875 for the revision of prices of gas in the Acts of 1868 attaching to the supply of gas by the companies supplying the City of London, had led to one or two Courts of Inquiry by Commissioners, resulting in considerable additions to the price of gas charged within the scope of the legislation of 1868. But the addition to the price was so large, and caused so much discontent in the then Metropolitan Board of Works and City Corporation, that, on the motion of the public authorities, concurrently with the applications to Parliament of the then Gas Light and Coke Company and the Commercial Company (and the Bills of the public authorities), the Bills were sent to a strong Committee, with the late Mr. W. E. Forster, of educational renown, in the chair.

Anterior to this—either in a separate paper read by himself before the then British Association of Gas Managers, or in a discussion, Sir George Livesey had promulgated the view that legislation on the lines of giving an additional dividend upon reduction of price of gas, coupled with that which had never existed before—a forfeiture of part of the dividend, in the like proportion, on raising the price of gas—would furnish the best readjustment possible, and would do away with the discontent then broadly felt by the consumers of gas.

The then Mr. Farrar, of the Board of Trade, had noticed this, and had expressed his approval of the principle, which was afterwards conveyed to Mr. Forster's Committee in an official letter.

The Commercial Gas Company's Bill had been strongly petitioned against, and was actually opposed by the Gas Light and Coke Company, who raised the extraordinary claim that, as they had amalgamated or absorbed most of the companies round London, they should be allowed to absorb the Commercial Gas Company—rather than that the latter Company should be permitted to itself absorb the smaller Ratcliff Gas Company, and go on alone.

This opposition was so strong that the position was felt by the Commercial Company to be extremely difficult—especially as the Gas Light and Coke Company had attacked its administration—particularly in connection with its application of reserve fund moneys to the capital purpose of the purchase of land, &c.

The late Mr. Cripps, for whom it was claimed recently in the "Times" that he had introduced the sliding-scale legislation, was simply the Agent for the joint opposition of the Corporation of London and the Metropolitan Board of Works.

The late Sir George Livesey and myself had long been converted to the sliding-scale principle—no less because, in the Bill of the Watford Gas Company (dated as far back as 1871), I procured the insertion of a sliding-scale clause, which went only half-way to the present system by allowing extra dividends to be paid on reductions of the price of gas, but with no penalty on raising the price above the standard.

Between us, we converted my father, Mr. Robert Jones, then the Engineer of the Commercial Gas Company, to our view; and he procured a consultation with the late Mr. William Newton, of the Metropolitan Board of Works (then the representative of the Mile End district, in which the Commercial Gas Company's works were situated), whereat it was settled that the Commercial Company would be willing to agree with the Metropolitan Board of Works upon the sliding-scale principle. When the time came that Mr. Farrar's letter endorsing Sir George Livesey's view was read out by Mr. Forster to his Committee, the Counsel for the Commercial Company was authorized to agree to the acceptance of it, and the Agent of the Metropolitan Board of Works was able to give their approval.

This is the secret history of the adoption by the Commercial Gas Company of the new legislation. But the Gas Light and Coke Company declined absolutely to accept it; and their Bill was withdrawn, or thrown out, and their opposition to the Commercial Company's Bill necessarily failed.

There is not the slightest doubt that Mr. Hunt's statement is absolutely correct. The late Sir George Livesey was not only the originator of the double sliding-scale, but he actively promoted its acceptance and adoption by the Commercial Gas Company and the public authorities, and so raised a storm of feeling against himself personally. In giving evidence in support of the Commercial Company's Bill, he was violently assailed by the chief Counsel for the Companies, the late Sir Edmund Beckett Denison, afterwards Lord Grimthorpe. So strong was the feeling on the part of the gas companies, that the Commercial Company and your humble servant and his father were for a long time looked at askance.

If I remember aright, the Imperial Gas Company in 1876, as well as the Gas Light and Coke Company, point-blank refused the sliding-scale, which was made conditional; but ultimately the Gas Light and Coke Company swallowed the pill. The South Metropolitan Company, coming later, were very disappointed that the terms they could get were not those given to the other companies—viz., 3s. 9d., with standard dividends of 10 and 7 per cent. on old and new capitals respectively. Sir George Livesey complained, naturally and bitterly, that because they had always supplied cheaper than the rest of the Metropolitan companies, the difference was maintained against them in the standard price allowed.

It was not really for many years after this that the engineers of the Metropolitan companies were converted to the system. All sorts of evasions were suggested; and a sterilizing neutral zone was actually introduced in some cases, through the influence of distrustful fears.

The sliding-scales before this were one-sided. I had introduced an incremental scale in the Watford Gas Company's Act of 1871; but there was no counterbalancing forfeiture on increasing the price of gas. Something of the kind existed in one of the Acts of the West Ham Gas Company.

The enormous benefit in security and permanence of dividend arising from the system, cannot fail to have impressed itself on the companies, as throughout the kingdom it now prevails. Notably, in the present conjunction it saves the position with regard to coal purchases, because it is understood, and has been declared in parliamentary discussion by the President of the Board of Trade, that any relief of burden goes directly to the gas consumer by the operation of the sliding-scale. Without this answer, those companies who are now so effectively helping in the Munitions of War would find their embarrassments considerable.

I have not the time to look up further points in the parliamentary history of the progress of the sliding-scale; but if I should go further into records, and they are of interest, they shall be at your service.

HY. E. JONES.

Palace Chambers, Westminster, S.W., Dec. 24, 1915.

Exports of Sulphate of Ammonia.

SIR,—On the 20th inst., the "Times" published an attack on the Board of Agriculture, making statements which implied that manufacturers of sulphate of ammonia were starving the home market in order to make profit in the export market.

As these assertions were entirely false—seeing that sulphate of ammonia manufacturers have accepted a heavy sacrifice in selling at £14 10s. for home use for November-December—we wrote to the Editor of the "Times," pointing out the facts. For reasons best known to that journal, they have declined to publish our letter.

We think it may interest you to see a copy, and accordingly enclose same herewith.

SULPHATE OF AMMONIA ASSOCIATION,
D. Milne Watson, Chairman.

84, *Horseferry Road, S.W.*,
Dec. 23, 1915.

[ENCLOSURE.]

SUPPLY OF NITROGEN.

To the Editor of the "Times."

Sir,—Our attention has been drawn to an article in your issue of the 20th inst., entitled, "Destination of Exports." We do not propose to go into all the points raised by your anonymous agricultural correspondent; but we cannot too emphatically say that, so far as sulphate of ammonia is concerned, only surplus production has been, and will be, exported.

Of the quantity reserved for British farmers at a low price to be applied as an autumn dressing, so far only 18 per cent. has been demanded; the balance is still being held in reserve. As regards the spring, we have arranged to reserve a large margin over and above normal requirements, and, in addition to this, a quantity sufficient to make up the total deficiency of nitrogen usually applied in the form of nitrate of soda, assuming that no further shipments of nitrate for agricultural use will be possible.

All British requirements in nitrogen are therefore being provided before a ton of sulphate of ammonia is exported.

SULPHATE OF AMMONIA ASSOCIATION,
Dec. 21, 1915. (Signed) D. Milne Watson, Chairman.

[Reference to the article alluded to by Mr. Milne Watson, and the reply of Mr. F. D. Acland thereto in the "Times," will be found among the "Miscellaneous News," p. 717.—ED. J.G.L.]

Concerning Naphthalene Troubles.

SIR,—Having suffered considerably in the past through the difficulties of gas supply due to naphthalene deposits, I can fully sympathize with those in charge of gas concerns now going through a similar disturbing experience—an experience made all the more serious because of the absolute necessity, in these competitive days, for the prevention of discomfort and annoyance caused to the consumer in respect of inadequate pressure or total failure of the gas service. This being so, I trust it may not be out of place to offer the following description of the practical working here, as of interest to your readers.

Curiously enough, as in past periods of trouble when naphthalene was prevalent in one town and not in another, so it is found (up to date at all events) that with the "C" process in action at the works here no seriously increased cause for complaint has been marked, while in other concerns the trouble is obviously acute.

The following comparative statement giving the records of stopped services due to the deposit of naphthalene will clearly show that this is borne out by results. The naphthalene present in the outgoing gas is also added.

1914.	Complaints Per Cent. of Consumers.	Naphthalene in Outgoing Gas. Grains per 100 Cubic Feet.	Complaints Per Cent. of Consumers.	Naphthalene in Outgoing Gas. Grains per 100 Cubic Feet.	1915.
Jan. .	1·2	5·7	·5	6·3	Jan.
Feb. .	·2	6·7	·4	5·7	Feb.
March	·4	4·25	·3	7·5	Mar.
April .	·2	6·8	·1	7·2	April
May .	·3	7·0	·1	6·0	May*
June .	1·2	8·12	·6	6·0	June
July .	1·8	8·43	·5	7·2	July
August	1·2	10·4	·6	7·4	August
Sept. .	·6	8·3	·7	7·7	Sept.
Oct. .	·8	8·2	·6	10·5	Oct.
Nov. .	·8	8·0	1·09	8·0	Nov.
Dec. .	1·01	7·5	·5	7·5	Dec. 23

* The "C" process was started in May last.

The description of coal used in 1914-15 was Durham, with 1 per cent. of Yorkshire gas coals. There is no water-gas plant installed.

As set forth and described in a few notes contained in my paper, "Gas Practice at Great Yarmouth," read before the Eastern Counties

Gas Managers' Association at Stamford in 1909, it has been for many years the rule to scrub the gas in a washer containing anthracene oil, as also to use on the outlet mains a "Simplex" vaporizer and enricher in which petroleum and carburine when necessary are employed in similar manner to that described by Mr. Price in a recent letter on this question, again to keep petroleum on the gasholder tank water—the latter idea having been found to reduce wet naphthalene deposits, which when occurring present the mischief in its very worst form and most difficult of removal.

Although the reduction of the naphthalene content in the outgoing gas, as shown, is not as low as obtains in many cases which have come under notice, yet it has not been found that any particular variation in the number of complaints has been recorded over that of the earlier days of experimenting here, when for long periods the recorded figures were 3 to 3½ grains per 100 cubic feet; and I am sure that many will bear me out as having had like experiences in this regard.

There is no doubt that the suggestion of vaporizing petroleum—no matter what plant is used—does very largely assist in the alleviation of the difficulty. But I must confess that it is nevertheless as well to have a force pump or two at hand. I cannot think, although it has been stated, that there is, under varying conditions of temperature, absolute freedom from naphthalene nuisance in the gas services.

I would like to add that our carbonizing is effected by machine charged, fairly well filled horizontal retorts working eight-hour charges, and would suggest that it would be most helpful (for comparison) if, when writing on this important subject, the descriptions of the coals used, the percentage of water gas sent out, as well as the systems of retorts (whether vertical, horizontal, or chambers) and the method of working are given.

Quite recently in working the "C" process here, it has been found an advantage to add a convenient quantity of anthracene oil to the tar flowing through the washer, and to allow the treated tar to overflow by way of a syphon pipe connected to the bottom of the vessel, instead of at the usual working level, in order to maintain the washing agent in a more uniformly liquid condition and to avoid the possibility of absorption by the gas of naphthalene contained in heavy tar accumulating through any cause whatever.

WILLIAM T. CARPENTER.

Great Yarmouth, Dec. 24, 1915.

Gas-Fires and Electric Radiators.

SIR,—May I reply to the comments in your issue of the 21st inst., relative to my recent lecture on electric radiators at the University College?

It is not quite clear why you should think that the remark on gas-fires was evidence of a desire "to say something to please an electrical audience." I am often accused of saying very unpalatable things to technical audiences, but not often of the opposite tendency.

It appears from the Technical Press that this reference to gas-fires has been misunderstood, although the MS. of the lecture seems to be perfectly clear. In drawing a distinction between the air temperature and what I have called the "radiant temperature," it was pointed out that there is a certain temperature below which the air of a room should not be allowed to fall if comfort is to be secured—that no degree of radiant intensity (even one which scorches any fabric exposed to it) would compensate for too low an air temperature. The remark about gas-fires was to the effect that manufacturers of these had devoted so much attention to the improvement of the "radiant efficiency" that the air of a room may be insufficiently warmed although the radiant temperature may be so high as to scorch the knees of a person sitting 4 feet away from it. There was nothing about the glowing fire-clay being too hot.

Taken by itself, the temperature of the radiant element is not the essential point of the problem. Also the word "efficiency" in connection with any heating apparatus has only a very circumscribed meaning. It would be equally true to say that the efficiency of an electric heater must be in all cases exactly 100 per cent, as that it is generally rather less than 20 per cent. A "gas-radiator," too, may be said to have an efficiency of 100 per cent. or to be generally not more than 15 per cent. The same gas-fire might be said with perfect truth to have perhaps either 75 or 50 or 25 or 11 per cent. or less, all according to what is meant by "efficiency"—if, indeed, this expression can properly be used in connection with heating.

Its use in a commercial connection is certainly quite out of place for comparing two different methods of heating. The user is only concerned with the question, "What will it cost per week to make this room feel comfortably warm whenever I want to use it, and what is the most convenient means?"

These questions are much more complex than the scientific "efficiency" of the heaters employed, or the surface temperatures of the radiant elements, which considerations are only a small fraction of the whole problem. The user cannot say how often, or how long, he is going to use the room; nor how long before he uses it he will light the stove. He does not know what are the conditions which make the room feel comfortably warm. For the matter of that, neither does the gas engineer, nor the electrical engineer, nor, I believe, does anybody else! It is the very difficult problem we have been attempting to solve in my laboratory for years, the nature of which I made an attempt to explain in the lecture on which you comment.

May I be permitted to say that this perennial and somewhat acrid controversy between the gas and the electrical interests in this and similar connections seems, to an outsider who is solely interested in the object to be attained, to be sometimes more entertaining than instructive or dignified. Statements are constantly made by partisans of both sides which are so untrue or inapposite as to show that their authors have no title to be heard on the matter at all.

Is it permissible to plead for a more general recognition of the real essentials of the problem—for more light and less "hot air?"

A. H. BARKER.

University College, Gower Street, Dec. 24, 1915.

The Sanco Gas-Mantle Company has been registered at Somerset House, with a capital of £5000, in £1 shares. The offices are at Nos. 84 to 86, Chancery Lane, W.C.

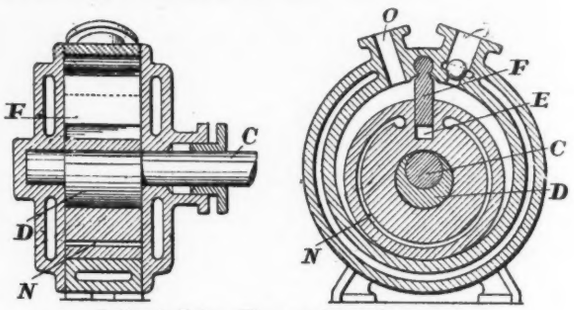
REGISTER OF PATENTS.

Rotary Blowers and Gas-Compressors.

GÜTTNER, M., of Schmölln, Saxe-Altenburg, Germany.

No. 8003; May 29, 1915. Convention date, Dec. 19, 1914.

In rotary blowers and gas-compressors with a cylindrical piston eccentrically driven within a cylindrical casing, as described in patent No. 6896 of 1914, the cylindrical surface of the piston is mentioned as covered with a skin of elastic material in order to secure a tight fit between the surface and the cylindrical wall of the casing. This arrangement, it is said, offered the advantage of allowing each individual part of the piston surface to adapt itself most intimately to the part of the casing wall which it would come in passing contact with during each revolution of the piston shaft—thus rendering the tight fit between piston and casing still tighter in course of time. The arrangement according to the present invention is claimed to be an improvement—the elastic cover on the piston being replaced by a preferably ring-shaped slit intersecting the solid piston at such a distance below its outer surface that the part of the piston confined between the slit and the piston surface is rendered elastic.



Guttner's Rotary Blower and Gas-Compressor.

The preferred form of blower or compressor is shown in vertical longitudinal section and vertical cross section.

D is the eccentric block inserted between the shaft and the piston and movable within the latter. E is a rectangular radial longitudinal slot cut in the piston; and F is a tongue freely working therein in a radial direction and jointed to the casing wall by a cylinder joint. O is the gas inlet, and P is the outlet preferably provided with a ball-valve. A slit N in the piston extends all through it in a longitudinal direction and almost all around it; "so that its section has the appearance of a ring with a gap in it." The distance between the slit and the outer surface of the piston is such that the part of the piston enclosed between the slit and the piston surface is elastic to a certain extent.

The shaft C, in rotating with the block D fixed on it, causes the piston to execute a composite movement resulting from an oscillation around the pivot of the tongue F and a vertical oscillation along a straight line—this, it is claimed, being of importance in so far as the single parts of the circumference of the piston are thus continually brought in contact with the same parts of the casing wall, and the piston surface is thereby enabled to adapt itself in an always increasing degree to the inner surface of the casing.

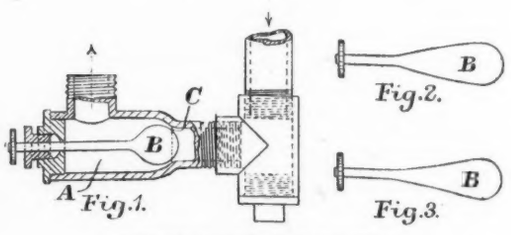
Controllers for Gas-Fires.

GRAFTON, W., of Glasgow.

No. 13,487; June 18, 1915.

This appliance is intended to control the supply of gas to gas-fires so that it will be noiseless during its passage to the injector.

The appliance (in the words of the patentee) consists of a regulating valve comprising a manually adjustable valve-head member having a substantially spherical seat-engaging face for co-operation with a correspondingly formed seat and having a stem behind the face ("behind" being considered in the direction of flow), and a valve chamber which is internally unobstructed and the passage into which



Grafton's Controller for Gas-Fires.

is controlled by the member; the chamber being rounded internally in conformity with the valve member to present a valve seat, and so formed and dimensioned that the clear cross-sectional area of the passage for the gas increases progressively beyond the point where the gas passes between the valve-head and the seat. The valve-head is a partial obstacle to the fluid stream. The stream divides at some point in front of the obstacle, and passes around it in a series of well-defined lines that ultimately close together again at some point behind the

obstacle. In some cases these stream-lines conform to the profile of the obstacle itself for the greater part of its length; and when this happens, the form of the obstacle within limits is such that it offers the least possible resistance to motion in the fluid, and is of good stream-line form. The result of experimental research is that for a fluid such as gas to pass around an obstacle with the least resistance and friction, the tail end of the controlling member is fundamentally more important than the head; and therefore the blunt end or edge should always be in front—*i.e.*, opposing the flow. Any sudden change of curvature is to be avoided.

The invention is illustrated (p. 710) by a sectional view of one form, and two modifications of the controller head.

In communication with the gas-supply pipe is an internally unobstructed valve chamber A in which is a manually adjustable valve B co-operating with an apertured valve-seat, the aperture C of which is of less area than the cross-sectional area of the valve chamber. It is understood that the valve chamber is in communication with the injector member or members of the burners; the direction in which the gas flows on its way to the burners being shown by the arrow.

The patentee draws particular attention to the formation of the valve or controller head and of the valve-seat, "each of which is without any sharp edges." As shown, the design is to prevent sinuous motion such as to ensure that the stream-lines are undisturbed even with comparatively high velocity of the gas past the valve. To this end, the valve-head is formed with a spherical seat-engaging face which also assists the valve to be perfectly stable—*i.e.*, to have no tendency to travel out of the centre of the valve-seat. This spherical shape of the seat-engaging face permits a uniform flow around the valve and allows a gradual increase of velocity of the gas passing through the contracted space between the valve and the seat and a subsequent gradual decrease of velocity.

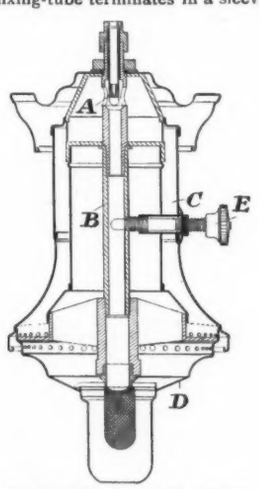
As shown in figs. 2 and 3, the controller head, in lieu of being nearly spherical, may be of substantially "ichthyoidal" form.

Lamp for Gas under Pressure with Previously Heated Primary Air Supply.

EHRICH AND GRAETZ, of Berlin.

No. 23,174; Nov. 27, 1914. Convention date, Dec. 2, 1913.

The illustration shows the invention claimed. The gas, under pressure, issues from the nozzle A and flows into the mixing-tube B, at the same time drawing into it, by suction, the requisite supply of primary air through orifices which communicate with the preliminary heating chamber C. The mixing-tube terminates in a sleeve attached by ribs



Ehrich and Graetz's Gas-Lamp.

and an annular body to the lamp casing. The sleeve carries the burner-head. By a bayonet fastening, there is suspended, on the bottom part D (arranged to form a reflector) of the lamp casing, a well glass or chimney provided with a number of air-holes, preferably at the bottom. The primary air supply is regulated by a screw E.

The patentees state that the lamp may be used without any outer globe, even as an outdoor lamp.

Breaking-Down Clinker in Gas-Furnaces.

GILL, G. M., of Blackheath, DONALD, D. B., of East Dulwich, and JENKINSON, W., of Stepney.

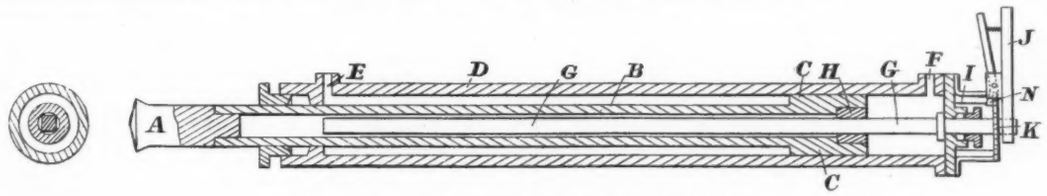
No. 24,426; Dec. 21, 1914.

This machine, for breaking-down clinker in furnaces, comprises a tool connected to a piston to which reciprocatory movement is imparted by fluid under pressure controlled by a hand-actuated valve and admitted to, and exhausted from, a cylinder supported on a portable carriage "in such manner as to be capable of participating in a universal movement." A machine of the kind is described in Gill's patent No. 23,862 of 1912. [See "JOURNAL," Vol. CXXIII., p. 709.]

A longitudinal section is given through the working cylinder and piston of the declinkering machine proposed; also a cross section.

The tool A is of chisel-shape carried by a hollow piston rod B formed integral with, or secured to, the piston C, which is adapted to operate within the cylinder D under the action of pressure fluid admitted alternately to opposite ends by ports E F, and through the medium of a suitable valve and pipe connections. The piston rod is adapted to slide or reciprocate upon a rod G, which extends through an orifice in a bush H secured to the piston, and is mounted in a stuffing-box I provided at the rear end of the cylinder. At this point the rod is of circular formation in cross section, and extends through the gland of the stuffing-box so as to receive a hand lever J for turning the rod, together with the piston and piston rod, through any desired angle. Thus the rod forms a support or guide whereon the piston and its rod may reciprocate to ensure of the cutting edge of the tool, after adjustment, delivering successive blows at any predetermined angular position.

Adjacent to the lever J is a notched member K, secured by brackets to the rear end of the cylinder. Pivotally connected to the lever is a hand controlled catch device N, which is normally held in engagement with one of the notches in K by a spring. By disengaging the catch device from the notched member, the hand lever can be moved into any desired angular position—the tool A moving with the hand lever through the intervention of the rod G and the piston C, with which the latter engages through the bush H.



Gill, Donald, and Jenkinson's Clinker Removing Tool.

The cylinder D is mounted on a portable carriage [not shown] to permit universal or swivelling movement of the cylinder, and means are provided whereby the machine can be fixed securely in position when the cutting tool is in action. A carriage of this description is described in the 1912 patent already referred to.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

Privately-Owned Railway Waggons.

Mr. NEVILLE asked the President of the Board of Trade whether the Government were proposing to pool the railway waggons of the country; and, if so, whether, before deciding on the form such pooling arrangement would take, he would consult the representatives of waggon companies and private owners?

Mr. RUNCIMAN replied that it had been suggested by the Coal Mining Organization Committee and by the Port and Transit Executive Committee that railway waggons, including those belonging to private owners, should be pooled, and the suggestion was being carefully considered both by the Board of Trade and by the Railway Executive Committee. He recognized that there were great difficulties in the way of such a scheme. The interests of waggon companies and other private owners would, of course, be carefully considered, and representatives of those interests consulted before any decision could be come to.

Price and Quality of Gas.

Mr. W. THORNE asked the Minister of Munitions if he was aware that the loss in the illuminating and heating power of gas caused by benzol, toluol, and xylol being extracted could be made good by the use of oil and cannel coal; and if he will require gas undertakings where the test is abolished to use artificial substances to maintain the quality of gas or otherwise reduce the price to consumers.

Dr. ADDISON replied that consideration of cost and of difficulty in obtaining the materials required restrict the possibility of adopting the processes described, and—as the Minister of Munitions had previously explained—the deterioration in the quality of the gas supplied to consumers is hardly appreciable.

British Gas Undertakings in Germany.

Notice of the following questions has been given by Mr. King for next week: (1) To ask the President of the Board of Trade whether he is aware that at the opening of the war the gas undertaking of Frankfort-on-the-Main was in the hands of a British Company, and has now become the property of the Municipality; and whether this transfer, which was contemplated by a pre-war arrangement made by the Company, has had the attention and sanction of the Board of Trade. (2) Whether he is aware that several millions of British capital have been sunk in undertakings supplying coal gas to the public in various cities of Germany, Austria, Hungary, and Belgium; whether a register is being kept of undertakings of this and similar kinds in enemy countries; and whether, in any steps taken by the Government against enemy property, British interests abroad will be borne in mind.

LEGAL INTELLIGENCE.

United Gas-Works Development Company.

A petition presented by Messrs. Firth Blakeley, Sons, and Co., asking that the United Gas-Works Development Company might be wound-up under the supervision of the Court, came before Mr. Justice Neville last Tuesday. Mr. Willis, for the petitioners, said he understood the Company did not object to a supervision order; and Mr. Hilyard, for the Company, intimating that he did not oppose, his Lordship made the order as asked.

A Disputed Sulphate of Ammonia Contract.

In the King's Bench Division, before Mr. Justice Shearman, Messrs. S. F. Waters and Co. sued Messrs. Cochrane and Co. for an alleged breach of contract. Mr. G. Neilson, for the plaintiffs, stated that the contract was set out in the various letters and telegrams which had passed between the parties. The arrangement was that defendants should supply 50 tons of sulphate of ammonia per month for six months, from January to June, at a charge of £11 6s. 6d. per ton. The defence raised was that defendants had agreed to supply only 150 tons. By a mistake this was the amount specified in the contract; and also by an error plaintiffs' clerk wrote acknowledging receipt of the contract note as being all in order. The price of sulphate of ammonia had risen considerably since the contract was made. Mr. Raeburn, for the defence, contended that the plaintiffs were bound by their letter of acceptance of the contract note, which specified 150 tons. Mr. Alexander Crombie (manager to the defendants) stated that they had sufficient sulphate of ammonia to supply plaintiffs with 300 tons. The defendants considered that the contract was for only 150 tons; and the letter of acceptance confirmed this opinion. The 150 tons specified in the contract note was not a clerical error. His Lordship said there was evidently a mistake made by the plaintiffs as to the quantity which had been purchased, and by the defendants as to the total to be supplied. The amount was to be fixed in the contract note; and this was approved by the letter written by the plaintiffs. The plaintiffs had failed to make out their case; and he dismissed the action, with costs.

Claim by an Engineer of the Garden City.

In the King's Bench Division of the High Court of Justice, before Mr. Justice Darling and a Special Jury, Mr. Samuel Holt Donnelly sued the First Garden City, Limited, Letchworth, for remuneration which he alleged was due to him in connection with an improved water supply scheme whereby he enabled the Company to effect a saving of nearly £2000. Mr. Schiller, K.C., and Mr. Lincoln Reed appeared for the plaintiff; and the defendants were represented by Mr. Hawke, K.C., and Mr. Hunter Gray. Mr. Schiller said his client was a fully-qualified engineer of considerable inventive skill, and was the owner of several patents. Early in 1913, the defendants contemplated adding to their water supply plant by installing more pumps and a new rising main, in order that an extra supply of water might be pumped into the existing reservoir. The amount to be expended upon the new rising main was estimated by the defendants' Engineer (Mr. A. W. Bullmore) at £2000. It was hoped that by means of the new installation the supply would be increased to 40,000 gallons per hour. While the plans were under consideration, the plaintiff (who was in the Company's service) was struck with an idea. He recommended that the old rising main and the distributing main should be coupled, in order that both mains might be utilized in pumping the water into the reservoir. The result was that the Company were enabled to dispense with the projected new rising main. The expenditure involved in putting the plaintiff's idea into execution was only £160. When the question of remuneration was suggested, the Chief Engineer told Mr. Donnelly to leave the matter to him, and it would be all right. Inasmuch as he was in the employ of the Company, plaintiff relied upon the promise made; but after waiting for some considerable time, he did not receive the remuneration anticipated. It was true the Company had granted him a gratuity in connection with the work done in respect of the installation; but this was purely voluntary recognition of the zeal displayed by the staff. Plaintiff, in evidence, said he was claiming £900, or 50 per cent. of the actual saving by the use of his invention. Mr. Hawke, for the defence, contended that no evidence had been given in support of a suggestion that Mr. Bullmore had made a specific promise as to remuneration; and that, if such promise were, in fact, made, the Chief Engineer had no authority for making it. Mr. Bullmore stated that at no time did he make an agreement with Mr. Donnelly as to payment in respect of his invention. The distributing main had upon several occasions before Mr. Donnelly was engaged been used as both a rising and distributing main. The original sketch drawn by Mr. Donnelly was the result of instructions previously given by witness. The idea of coupling the mains, as represented, was a very old one. The Jury returned a verdict for the defendants, and judgment was given for them, with costs.

Loan Question at Stratford-on-Avon.—Some months ago, it was stated that the Local Government Board had refused to sanction a loan for further plant at the gas-works of the Stratford-on-Avon Corporation, and that the Council had come to an arrangement with Messrs. W. C. Holmes and Co. to carry out the work and charge a rental till it was possible to get a loan. The point then arose as to whether the previous carrying out of the work would prejudice the Corporation in their request for sanction to a loan; and as the result of correspondence, the Board have written stating that, in the special circumstances, the fact that the work had been proceeded with would not be regarded as in itself a sufficient reason for withholding sanction to a loan.

MISCELLANEOUS NEWS.

SOUTH METROPOLITAN COMPANY'S CAPITAL POWERS.

Various financial matters are dealt with in the Bill which, as already intimated in the pages of the "JOURNAL," the South Metropolitan Gas Company are promoting to authorize them to raise additional capital, and for other purposes.

It is felt by the Company that the provisions in their existing Acts with respect to the proportion to be maintained between the amount of money raised by the issue of ordinary stock on the one hand and the nominal amount of the debenture stock of the Company on the other hand, are in some respects, inconsistent, and their combined effect is not free from doubt. Therefore, with the object of defining clearly the obligations of the Company in these matters, and of making provision for future capital expenditure, they seek the repeal of unexercised powers of issuing capital and debenture stock, and authorization to raise from time to time additional capital not exceeding in the whole £1,000,000 (including premiums), by the creation and issue of ordinary or preference stock, with provisions for borrowing on mortgage and the creation of debenture stock.

Under their Act of 1901, the Company are empowered in the first instance to offer to gas consumers and persons in their employ any ordinary stock proposed to be issued; and as regards any unissued ordinary stock which they may decide not so to submit, or which having been so offered is not taken, are required, before offering it to the holders of any other stock of the Company, to submit such stock for sale by public auction or tender at a reserve price not less than the nominal amount thereof. Other provisions are also enacted as to the mode of disposal of any stock submitted for sale by public auction or tender and not sold. As in the prevailing circumstances the Company are unable to dispose of their ordinary stock otherwise than at a price less than the nominal amount thereof, and in certain other respects the conditions governing the issue of the ordinary stock of the Company are inconvenient and obsolete, it is proposed that ordinary or preference stock created after the passing of the present Bill, whether at a premium or not, may (with the approval of the Board of Trade) be offered to all the gas consumers and persons in the employ of the Company at as near as may be the average market price of such stock in the fourteen days immediately preceding such offer (provided that in no case shall the price at which the stock is offered be lower than 7½ per cent. below such market price). The average market price will be ascertained from the "London Stock Exchange Official List." Any stock so taken up shall, before being offered to the holders of any other stock of the Company, be submitted for sale by public auction or tender. Any stock which has been submitted for sale by auction or tender in accordance with the procedure laid down, but not then sold, may be offered, at the reserve price fixed for that sale, to the holders of ordinary, preference, or debenture stock. Any stock which has been offered for sale in one or more of the ways here set forth, and is not sold, may be again submitted for sale by public auction or by tender; and any such stock then remaining unsold may be otherwise disposed of "at such price and in such manner as the Directors may determine for the purpose of realizing the best price obtainable." These provisions will not apply to the issue of debenture stock.

Power is also sought to raise (*a*) by the issue of redeemable preference stock any portion of the capital which the Company are or may be authorized to raise as preference capital, (*b*) by the issue of redeemable debenture stock any money which the Company are or may be authorized to raise by the issue of debenture stock. Also to issue new ordinary or preference stock (the latter redeemable or otherwise) to such amount as may be necessary to provide money for the redemption or purchase of any redeemable preference stock, or new debenture stock (redeemable or otherwise) to provide for the redemption or purchase of any redeemable debenture stock; and from time to time to set apart out of revenue "such sums as they may consider necessary for the purpose of redeeming any redeemable preference stock or redeemable debenture stock which they may desire to redeem otherwise than by the issue of new ordinary or preference stock or new debenture stock under the powers of this section."

IMPERIAL CONTINENTAL GAS ASSOCIATION.

Provisions of their Parliamentary Bill.

In the Bill which the Association are promoting to remove doubts as to their power to sell or dispose of portions of their undertaking, and for other purposes, one of the clauses provides that the powers of the Association shall be deemed to include, and as from the passing of their original Act of 1870 to have included, power to purchase, take on lease, hire, hold, use, and manage, any undertaking for the supply to any cities, towns, places, or persons in any foreign country or in any British Colony or Dependency, of gas or any other light, or means of producing light, already known or hereafter to be discovered; to transact, undertake, or carry on, upon such terms and conditions as the Association may think fit, in conjunction with any other corporation, company, association, body, or person, any operation, business, or undertaking which they are authorized under their statutory powers themselves to transact, undertake, or carry on; to purchase or acquire and to hold, exercise, perform, operate, and enjoy any rights, contracts, concessions, or privileges of a like character with, or of a character similar to, or connected with, or incidental to, the objects of the Association, whether singly or in conjunction with any other corporation, company, association, body, or person; to acquire stock or shares in any body carrying on an undertaking of which the objects are similar to, or connected with, or incidental to, the objects of the undertaking of the Association; to sell, vary, exchange, let, lease, transfer, surrender, or otherwise deal with, or dispose of, any such undertaking

as has been mentioned, business rights, contracts, shares, or stocks; and to establish, and provide funds for, in any place where the Association are empowered to carry on business, any subsidiary company or companies.

Further, the distribution of funds made pursuant to resolutions passed at the ordinary meetings of the Association held in November, 1914, and May last shall be deemed to have been lawfully made, and to have together constituted a dividend declared in November, 1914, and made and paid in respect of the period of six months ended June 30, 1914. It is pointed out in this connection that, owing to the war, the Association have only recently been able to complete the returns from their various stations and to prepare the accounts relating to the half year named, and are not yet in a position to make up accounts relating to any subsequent half year. At the meetings referred to, resolutions were passed adopting the recommendation of the Directors that a distribution on account of the profits of the said half year equivalent on each occasion to 2¼ per cent. on the capital stock of the Association should be made from funds which constituted income, notwithstanding that it had been impossible previous to the meetings to prepare a scheme showing the profits of the Association for the period current since the preceding ordinary meeting at which a dividend was declared, and that the period in respect of which the resolution was passed at the meeting in May last was not, or might be deemed not to have been, the period current since the preceding ordinary meeting at which a dividend was declared. Distributions were therefore made equivalent in the aggregate to 4½ per cent.; and it has since been ascertained that the total amount so distributed was less than the sum available for dividend on June 30, 1914.

The Association also desire to secure power to issue or dispose of any ordinary or preference stock, at such price as the Directors may think advantageous, "whether equal to the nominal amount or above or below that amount." The whole of the debenture stock has been issued subject to the condition that it shall be redeemable at the option of the Association at the price of £105 for every £100 of stock, at any time upon six months' notice; and it is sought to confirm this condition, and that the Association shall be empowered to attach a like condition to future issues. The cancellation of any debenture stock already so purchased by the Association is provided for, the issue of new debenture stock to pay off that existing, and the formation of a fund for redeeming any debenture stock at maturity, &c.

It shall not be necessary for the Association to hold more than one ordinary meeting in any year; and the Directors may, without calling stockholders together, declare an interim half-yearly dividend.

The final portion of the Bill deals with the constitution of the Board of the Association.

CO-PARTNERSHIP AND THE FUTURE.

Message from Mr. Charles Carpenter, D.Sc., to South Metropolitan Co-Partners.

The Christmas issue of the "Co-Partnership Journal" of the South Metropolitan Gas Company opens with the following message to the employees from Mr. Charles Carpenter, D.Sc., the Chairman of the Company,

The past year has been a trying one for our co-partnership. Unlike many industries, the business of gas manufacture has become much less profitable by reason of the high price paid for coal, with the result that, by the automatic arrangement of the sliding-scale, the bonus available for co-partners has been seriously reduced. In this respect they share with the shareholders and the consumers of gas the burden of hard times. Yet, in spite of this, our employees are taxing themselves to the extent of £250 per week in order that the dependants of those who are fighting for, and also of those who have fallen in defence of, our beloved Empire may be assisted in their weekly wants. This sacrifice of comforts on their part speaks splendidly for the animating spirit of our co-partnership, and goes to prove how solid and secure is the foundation upon which it rests. How often must many of us have thought, when reading of labour troubles here, there, and elsewhere, "What a good thing it would be if the country were one huge co-partnership, where the aim of everyone was not only to do his bit but his best, in its hour of trial!"

We may pride ourselves upon the fact that, through good and evil repute, we have done our best these last six-and-twenty years to practise, as well as to preach, principles of mutual trust and effort. If more of the nation and more of its leaders, whether of workmen, or of capital, or of politics, had listened to our endeavours to arouse their lethargy or dispel their prejudice, there is no doubt the nation would have found itself to-day incomparably better equipped to meet the onslaughts of its enemies.

Serious though the position is to-day, the industrial war which is bound to follow the conclusion of the present bloody one is likely to be waged not less bitterly. The nation will then be in great need that all the inhabitants of this land, whether men or masters, shall have fitted themselves to meet the new conditions of wages which are bound to arise.

As co-partners, we can honestly urge them to give an important place to co-partnership in those considerations of increased security and efficiency to which attention should be given during

THE NEW YEAR.

Neath Labour Dispute Ended.—Labour trouble has threatened at the Neath Corporation Gas-Works; but fortunately a cessation of work has been avoided, notices tendered by the men having been withdrawn unconditionally. The dispute originally only affected a few of the yardmen; but the other workers had given notice in sympathy. The men asked for an increase of 4d. per eight-hour shift, bringing the rate up to 5s. The Corporation expressed their willingness to concede the increased pay, provided the day men worked a nine-hour shift.

BRITISH COALITE COMPANY, LIMITED.

The Present Position of Affairs.

A considerable number of shareholders attended the ordinary general meeting of the British Coalite Company, Limited, at Salisbury House, E.C., last Thursday, to hear what Mr. W. J. FISHER, J.P. (the new Chairman), had to say with regard to the report and accounts for the year ended Sept. 30, and the present position of the undertaking. The substance of the report will be found on p. 655 of last week's issue of the "JOURNAL." The proprietors were met by a considerably changed Board—only two of the former Directors (Messrs. J. Conchie and S. N. Wellington, the Company's Consulting Engineer) remaining. Four other Directors (including the Chairman) joined the Board last July; a fifth (Mr. H. Willmott) at the beginning of this month.

The CHAIRMAN opened his remarks with a reference to the balance-sheet, as to which he said it was "perhaps better than most of its predecessors." The capital authorized remained the same, as did the deferred shares issued, while there had been an increase of 4750 in the number of ordinary shares issued, in connection with the scheme of re-organization carried out last year. Of the debentures, the 5 per cent. first mortgage debentures were about to be paid off, consequent on the sale of the Barking property, on which they were secured; and there had been an addition made to the number of second debentures issued, in order to provide capital to meet establishment charges and indebtedness in various directions. The Company's indebtedness, at the end of the financial year under consideration, still amounted to some £12,800 for accrued debenture interest, law charges, loans, &c. On the other hand, they had to set against the extinction of the first mortgage debentures the loss by sale of the Barking land. The original cost of this was £144,553; and it was sold by the previous Board for £71,500. The next item on the credit side, the Wednesfield land, should prove to be worth a great deal more than its purchase price of £22,192. Alluding to the advent of the new Board, the Chairman said, although he could not profess that "they had made themselves fully acquainted with the somewhat tangled past history of the Company, it did not take them long to discover that they had succeeded to a rather troublesome legacy of debt." This they were gradually clearing off; and they hoped that at no distant date the burden would disappear from the books. For the present, their only means of doing this was by placing some of the second debentures; and in the near future they trusted, not only that their holding in the Barnsley Smokeless Fuel Company, Limited, would become a considerable source of revenue, but that the improved position of the Company would enable them to place some of the unissued share capital. The completion of the sale of the Barking land, and the consequent extinction of the first mortgage debentures, should considerably improve the value of the second debentures, inasmuch as they would then become the first charge on the Company's properties. The purchase and sale of the Barking land did not, on the face of it, look like a very good bargain. However, they hoped that the £71,500 for which the land had been sold did not represent all they would eventually obtain from the sale. The purchasers were the County of London Electric Supply Company; and they proposed to erect on a portion of the land a large generating station. Negotiations were in progress with a view to working in co-operation with them on the lines of their taking from works to be erected the necessary gaseous fuel for use under their boilers, in place of coal. While he could not at the moment go into details as to this proposal, they had every hope that the arrangement, if carried out, would result in material benefit to this Company. In that case, the gaseous fuel they would supply would, of course, be subsidiary to other products resulting from the distillation—consisting of coalite itself, and various bye-products, including toluol, benzol, cresol, &c. Assuming, as they confidently did, the full success of the plant at Barugh, there should be no difficulty in obtaining all the money that would be required for the much larger plant at Barking; and they might anticipate being able to erect similar plants in various parts of the country, either on a royalty basis or by the formation of other subsidiary companies, as in the case of the Barnsley Smokeless Fuel Company, in which they held the bulk of the ordinary shares.

THE BARNSLEY SMOKELESS FUEL COMPANY.

Proceeding then to deal with the Company just named, the Chairman said the shareholders would have learnt from the Directors' report that the plant of the Barnsley Smokeless Fuel Company was in process of erection at Barugh, near Barnsley, under the direction of Mr. Stephen Wellington, and that, unfortunately, owing to circumstances beyond control, the cost had been greater, and progress had been slower, than was anticipated. The work, however, was proceeding satisfactorily. In this connection, he might say that arrangements were being made for the issue of the remaining £30,000 of 6 per cent. debentures of the Barnsley Smokeless Fuel Company, of which he had every hope the Treasury would again subscribe for a portion. Of the £20,000 already subscribed, the Treasury had taken one-half. The Company had also a contract with the Secretary of State for War to supply the Government with the whole of certain of their bye-products at market rates.

THEIR PROPERTY IN THE MIDLANDS.

Reference had, the Chairman continued, been made to the land at Wednesfield, which, though undoubtedly a valuable asset, had hitherto not only produced nothing, but had been a source of considerable expense, inasmuch as there, also, a plant was erected some years ago, and after a time disposed of. What would be the eventual use of the land, the Board were not at the moment prepared to say. It had a value undoubtedly, and the Directors believed a good one. In the balance-sheet, this was shown at cost; but it might, he thought, be taken as having a far greater value than that. This was some set-off against the loss on Barking. Some shareholders might remember that as long ago as 1907 a well-known coal-mining expert, Mr. C. E. Rhodes, in a report made to the Company, testified to the existence of a million tons of coal lying at no great depth below the surface. Coal was not likely for some time to fall to a very low price; and they might therefore endeavour to dispose of the Wednesfield coal on a royalty basis,

or to arrange for the erection of a low-temperature distillation plant for the treatment of the coal by their process. Before the outbreak of the war, the Company had begun negotiations with one of the largest of the London municipal electricity supply undertakings, for the construction of a plant capable of carbonizing 500 tons of coal a day. The whole of the gas generated from this would have been taken by the municipality as motive power for generating electricity; and for the coalite and bye-products a ready market could undoubtedly be found. There was every hope that when peace came again, these negotiations might be resumed and have a successful issue. With reference to what were called the bye-products of the process—such as toluol, benzol, cresol, tar, and other substances—there was not only a good market, but one that was rising steadily in value and importance. Apart from the toluol and cresol, the main value of which was as a basis for the highest form of explosives, there were the valuable dyes derived from coal tar. "Unless," he said, "we are, as a nation, to profit nothing by the lessons of the present war—a proposition that is wholly unthinkable—this Company should in the future find a fruitful field for these products; and it must not be forgotten that by the low-temperature process of distilling coal—that is to say, by our patented process—the quantities of these substances obtained by us are many times greater than are obtained by the ordinary gas-works distillation of coal." As to the patents, they were not only jealously protecting them, but had in the course of the year added several to the number. These dealt more particularly with retort-setting and discharging and quenching the coalite—two very important operations.

PROFESSOR LEWES AND MR. T. PARKER.

The Chairman concluded: "I have, unhappily, to finish on a somewhat sad note. It is with very great regret that I have to record the death of Professor Vivian B. Lewes, who almost from its beginnings was closely associated with the development of the coalite process, and in whom we have lost a loyal and consistent supporter of the low-temperature carbonization of coal. Further, I have to record with equal regret the death, within the last few weeks, of Mr. Thomas Parker, the inventor of the coalite process. Both these gentlemen had rendered eminent services to Science, and their deaths may truly be considered a national loss." He then formally moved the adoption of the report and accounts.

Mr. H. WILLMOTT, in seconding the motion, said he had been induced to take a seat at the Board by the belief that the Company had good prospects. He understood that Mr. Wellington had found means of improving the original process. They had such a property, he felt, that they would all be glad to be associated with coalite. There had been many imitations coming along during the last ten years; and they must have seen that there was something in the idea, or they would not have put their money down.

Mr. G. PRATT inquired who was advising the Company in the first place to buy the land at Barking at so extravagant a price.

The CHAIRMAN replied that he could not say who was responsible for it.

Mr. W. H. BEHRENS, referring to the Barnsley installation, remarked that if it proved a success there was an immense field for future development in that coal area alone. He hoped one effect of the war would be to wake the nation up to the waste in regard to what was probably the most valuable asset of this country. For very many years, England had been in advance of the whole world in the production of coal and its application for various purposes; yet they had let another country pass them in connection with almost every industry that was allied to coal distillation. Even for the erection of the ovens necessary, they had had to go to Germany.

The CHAIRMAN, in dealing with some remarks made by a shareholder as to the quality of coalite, said he believed that originally it did project a sort of powder into the rooms in which it was used; but except for this, it was quite satisfactory. Later makes of coalite were, he agreed, not so good. With the present plant, however, it was very satisfactory; and they anticipated that, when they reached the fullest capacity, the coalite turned out would leave nothing to be desired.

The resolution was then carried unanimously; and thereafter the retiring members of the Board and the Auditors were re-elected, and the Chairman and Directors were thanked for their services.

COLONIAL GAS ASSOCIATION, LIMITED.

At the Meeting of the Association which is to be held on Thursday of this week, the Directors will present accounts for the year ended June 30, which show that, including the amount brought forward from last year, and after providing fully for depreciation, debenture and other interest, adding £410 to the reserve fund account, and deducting the interim dividend paid last May, there remains a sum of £6064 available for final dividend. This the Directors recommend to be at the rate of 3 per cent. (making, with the interim dividend of 3 per cent., 6 per cent. for the year); leaving £1891 to be carried forward to next year's accounts. Owing, however, to insufficiency of capital, all available funds have had to be used for absolutely necessary capital purposes; and these funds will have to be released by the issue of fresh capital before such dividend can be paid. Resolutions with regard to the raising of additional capital will be submitted for the approval of the shareholders.

As compared with the previous year, the sales of gas show an increase of 8 per cent. In addition to the issue of shares consequent upon the purchase of the Footscray undertaking, the share capital was increased during the year by the issue of 1315 shares of £5 each, at par. Eighteen additional debentures of £100 each were also issued at par. The Directors announce with regret the death of their colleague Mr. William Swinburne, who had for many years taken an active part in the management of the Association in Australia, and latterly acted as Managing-Director. Mr. Samuel E. Figgis, for a long time Engineer and General Manager of the Ballarat Gas Company, now acts as the Managing-Director in Australia.

FACTORY AND WORKSHOP LIGHTING.

Records of Observations.

During the months of September and October last, a considerable amount of space in the "JOURNAL" was devoted to the task of fully dealing with two volumes of the first report of the Departmental Committee on Lighting in Factories and Workshops. Vol. I. contained the Committee's report and appendices; Vol. II., the minutes of evidence; and now Vol. III. has made its appearance, in the shape of records of observations. On the preparation of the material for this last volume much time and care must have been expended; for there are close upon 200 pages, mostly filled with figures and diagrams.

It is stated that the records of observations contained in this appendix were secured in the winter months of 1913-14, at the instance of the Committee, in order to reveal as far as possible the lighting conditions under which some of the chief industries of the country are carried on at the present time. The actual observations were made by Mr. J. W. T. Walsh, B.Sc., of the National Physical Laboratory, and Mr. G. F. Sedgwick, H.M. Inspectors' Assistant, under the direction of the Secretaries of the Committee; and the Committee indicate their indebtedness to the two observers for the thorough way in which they carried out their work. The records are not put forward with any claim to being exhaustive. It is, in fact, admitted that they must not be regarded as giving more than a very general idea of lighting conditions in certain representative factories in the engineering, textile, and clothing industries. The relatively short period each day during which factories are working under artificial light, affords only a limited opportunity for observations after dusk; but use was made of practically all the available time during which such observations were at all possible.

The selection of factories was made as representative as practicable; and, in the opinion of the Committee, for the chief industries studied the average results given in the summaries would not in most cases have been much affected had a larger number of obserations been available. Generally speaking, the observations were made in engineering, textile, or clothing factories in and around London, Glasgow, Belfast, Manchester, Leeds, Liverpool, Newcastle, Nottingham, Sheffield, and Bristol. It was originally intended for measurements to be made in the Birmingham and Cardiff districts; but time did not permit, and therefore this work had to be left for a future report. As the result of a preliminary tour by one of the Secretaries, both well and indifferently lighted factories were selected; the total number chosen being 54. In many cases, the factories were too extensive to permit of the taking of observations in all the rooms; and then rooms were selected which were as far as possible representative of the lighting conditions throughout the factory. Where the factories had both new and old sections, the choice of rooms for observation was divided as evenly as possible between the two.

Then, in each room the selection of observation points was carried out on the same principle; attention being in the main directed to the illumination at floors and gangways, and also at the point where work was being carried on. The method adopted was to place the white test-card at the observation point and measure the illumination. When gangways and floors were being dealt with, the card was placed on the ground in one or two representative positions; a point being usually chosen which would serve equally well for observations by both natural and artificial light. The Committee remark that the illumination at any point by artificial light is in ordinary circumstances a fairly constant quantity. Changes are liable to occur owing to fluctuations of the supply pressure, or to accumulations of dirt on the lamps and fittings; but in any well-regulated installation changes due to such causes are not great, and the recorded observations may be taken as showing definitely the illumination at the various points by artificial light. The matter is, of course, otherwise with natural lighting; but this section of the observations there is no need to deal with here.

In connection with every one of the 54 factories visited, a plan of the room (reproduced to scale) appears in the report, showing the points at which the observations were made; and full details are given of the means of lighting adopted, the results of the tests, and the Committee's opinions as to the adequacy or otherwise of the illumination. A full page is allotted to every room in which observations were made; and the rooms are grouped according to the industries and processes carried on in them. Each group of records dealing with a special industry or process is preceded by a summary, in which an effort has been made to collate all the results for the industry, and present them in a way which will enable a general survey of the lighting conditions to be obtained at a glance.

FACTORY FLOORS.

Measurements of the illumination at floor level were made in nearly all the factories visited. In the majority of cases it was found that attention was paid to the general illumination of workshops by providing for a certain number of general lighting units. But in some instances no such provision was made; the lighting units being placed solely with the object of illuminating some point of work, and the floor illumination being left to chance. The results in practice of this procedure, though sometimes fairly good, were often unsatisfactory. Sometimes it led to even dangerous under-illumination of certain parts of the rooms where no work was being carried on, but over which it was necessary for the workpeople to pass. Some of the rooms in the spinning-mills visited were particularly noticeable in this respect. In these, the lighting units were placed about 6 feet from the floor, along the alleys between the frames; the result being that, owing to obstruction of the light by the frames, the main central alleys, running at right angles, were left with an amount of light which appeared to be quite inadequate.

A general analysis of the floor lighting shows that in foundries 36 per cent. of the observations were below 0·25 foot-candle, 63 per cent. below 0·5 foot-candle, 76 per cent. below 0·75 foot-candle, 85 per cent. below 1 foot-candle, 90 per cent. below 1·25 foot-candles, 93 per

cent. below 1·5 foot-candles, 95 per cent. below 1·75 foot-candles, and 96 per cent. below 2 foot-candles. In the case of all other factories than foundries, the figures were 24 per cent. below 0 25 foot-candle, 52 per cent. below 0·5 foot-candle, 71 per cent. below 0 75 foot-candle, 83 per cent. below 1 foot-candle, 91 per cent. below 1·25 foot-candles, 95 per cent. below 1·5 foot-candles, 97 per cent. below 1·75 foot-candles, and 98 per cent. below 2 foot-candles. Thus in the case of foundries only 4 per cent ; and with other factories only 2 per cent., of the observations exceeded 2 foot-candles. The point above and below which there were equal numbers of observations was 0·4 foot-candle in the case of foundries, and 0·5 foot-candle for other factories.

Weaving Sheds.

Taking the industries separately, the first dealt with in the report is weaving; and here, of the eleven sheds visited, artificial light measurements were made in nine. In most cases the lamps were shaded by enamel or opal shades of the ordinary shape; but in one shed a new form of metallic reflector was in use, and was stated to have been found a distinct improvement. The usual method of placing the lights is to have one lamp over every pair of looms; or, in cases where the candle power of the lamp is higher, one over the centre of every group of four looms. Generally, the height of the lamps is from 5 to 7 feet, which is as low as they can be put without causing inconvenience to the operatives moving about under them. With such an arrangement as this, it is remarked, it is clear that the ordinary form of shade is unsatisfactory, on account of the glare due to the rows of bare lamps seen on raising the eyes from the looms. The improvement in this direction from the use in some cases of metallic reflectors was very noticeable.

The observations indicated a decided leaning towards an illumination of between 1 and 2 foot-candles at the surface of the cloth on the looms. Of the total number of observations, 2 per cent. were above 10 foot-candles. In the case of the floor measurements, practically the whole of the results were below 1 foot-candle. The point above and below which there were equal numbers of observations was 2 foot-candles in the case of the looms, and 0·4 foot-candle for the floors.

Spinning and Incidental Processes.

Under this head, measurements were made in 22 rooms; and the systems of lighting met with included batswing burners, upright and inverted incandescent mantles, high-pressure gas, and electric glow lamps. In many cases where no special lights were provided to illuminate the gangways, these were found to be very badly under-illuminated. As to the lighting of machines, the results show a considerable diversity in the values, with a tendency towards an exceedingly low illumination in many mills. Approximately, 3 per cent. of the observations were above 4 foot-candles; the point above and below which the number of observations were equal being 0·6 foot-candle. In the case of spinning mules, there was less variation in the illumination; but over 60 per cent. of the observations were below 0·5 foot-candle—the point above and below which the number of observations were equal being 0·4 foot-candle. In the case of the floors, the mid-point was 0·6 candle.

Lace and Hosiery Making.

Of ten rooms in lace factories which were visited, two were lit by electric incandescent lamps alone, four by high-pressure gas (in one case with a subsidiary system of electric lighting), and four by batswing burners. The last-named system, it is remarked, was obviously quite insufficient; and the workers complained of the poorness of the illumination. In the large majority of lace-machine rooms, the chief requirement is a moderate general light over all the working parts, and the possibility of producing a high local illumination at any desired spot. For this purpose, the most suitable system of lighting seen consisted of counterweighted lamps, capable of being readily pulled down and directed towards any particular point which it was desired temporarily to illuminate. In regard to lace machines, the point at which there were an equal number of observations above and below was 0·7 foot-candle; but the observations refer mainly to the general illumination, and not to the local illumination available at need. The mid-point in the floor observations was 0·35 foot-candle—indicating that comparatively little attention can have been paid to the general illumination. With the winding machines, the mid-point of the observations was 1 foot-candle.

The single hosiery factory visited was lit mainly by electricity; batswing burners being used only to aid the natural lighting on dark days. The illumination produced seemed generally sufficient; but the lighting units were so placed that the workpeople, while tending their machines, were compelled sometimes to stand in their own light. Several complaints on this ground were received from the workers; and an observation taken on the machine with the operative in his normal working position gave an illumination of 0·15 foot-candle, while the unobstructed illumination averaged 1 foot-candle. Here, again, more local lighting seemed to the investigators to be desirable; and they suggest that adjustable lights would undoubtedly have been a great convenience. The average floor illumination in this factory was about 0·5 foot-candle. The points above and below which there were equal numbers of observations were 1·3 foot-candles at the hosiery machines, and 1 foot-candle at the winding machines.

General Engineering.

In connection with general engineering (excluding foundries), a total number of 43 shops were subjected to measurement of the artificial illumination. The lighting systems met with included batswing burners, upright and inverted ordinary incandescent gas, high-pressure gas, electric glow lamps, and arc lamps. In several factories where arc lamps were employed, the lights seemed to be hung too low to give the most satisfactory general illumination; and in this way, dense black shadows were often formed. There was also one complaint of glare, owing to the low position of the lighting units. When electric glow lamps were used for local lighting, they were frequently, but by no means always, efficiently shaded. The shades for the lamps illuminating offices and for bench work generally were mostly of the ordinary enamelled iron form; and it is remarked that probably in many cases parabolic or similar specially-designed shades would give more satisfactory results. For illuminating machines such as lathes, where the local light had to be close to the work, the most satisfactory kind of shade appeared to be of conical form.

For machine work, the figures indicate that there is no very definite illumination which is regarded as the best for this kind of work; and while about one-third of the observations were below 1 foot-candle, there is an equal proportion above 2·5 foot-candles. Approximately, 8 per cent. of the observations were above 10 foot-candles. The middle point—that above and below which there were equal numbers of observations—was 1·6 foot candles. In the case of bench work, approximately one-third of the observations were below 1·25 foot-candles, one-third between that and 3 foot-candles, and the remaining one-third above this. This distribution indicates that bench work is allowed a higher degree of illumination than machine work. Of the observations, 6 per cent. were above 10 foot-candles; the mid-point being 1·8 foot-candles With heavy work—such as forging, spring making, rolling, &c —more than 50 per cent. of the observations were between 0·75 and 1 75 foot-candles; the mid-point being 1 foot-candle. The figures for floor illumination in all classes of machine shops indicate that comparatively few observations (about 24 per cent.) were above 1 foot-candle or below 0·4 foot-candle. The mid-point was 0·6 foot candle.

Foundries.

Of the eighteen foundries investigated, the chief system of lighting was by arc lamps in eight cases, by high or low pressure incandescent gas in three, by electric glow lamps in four, and by batswing burners in three. Seven of the foundries had local lighting by gas and electricity in addition to the main system. In many foundries the lighting seemed generally sufficient; but "it appeared particularly bad in those foundries lit mainly by batswing burners, some parts of which were clearly dangerous." It is pointed out that the chief disadvantage of lighting by isolated powerful sources—especially in foundries with low roofs—is the dense, black shadow cast by every object in the neighbourhood of a lamp. This makes it extremely hard to see the nature of the ground which happens to be in such a shadow; and it has been stated that accidents arise from this cause. It is particularly necessary, the report adds, that the passages and gangways of foundries should be well illuminated, as otherwise there is always some likelihood of treading upon hot metal which has been spilt in transit, but is no longer visible by its own incandescence. Approximately, 4 per cent. of the observations on the floors of foundries were above 2 foot-candles; the point above and below which there were equal numbers of observations being 0·4 foot-candle.

Clothing Workshops.

Measurements were made in 37 clothing workshops and sewing rooms. The lighting systems met with included batswing burners, upright and inverted incandescent mantles, electric glow lamps, and indirect lighting by inverted arcs. With sewing-machines, the light-sources were generally placed several feet away from the point of work; one source often serving to illuminate several machines. In only two factories was any attempt made at systematic localized lighting. In one of these, a small electric glow lamp in a metallic reflector was fixed to each machine, close to the work, so that the light was directed almost entirely on to the needle of the machine or its immediate neighbourhood. An electric lamp, on an adjustable arm, with an enamel shell shade, was provided in one factory for each machine. In only one room were deep metallic reflectors fitted, so as effectively to screen the lamps, which in all other cases were either unshaded or else fitted with opal or enamelled shades of the ordinary shallow conical shape.

The rooms for the purposes of the inquiry were divided into three classes: (1) Those used for sewing, either by hand or machine, on woollen or other cloth, generally of a dark colour; (2) those used for the less fine processes of cutting-out or pressing; (3) those in which the work was with white linen. A lower illumination is sufficient in rooms of the last-named class (in which the co-efficient of reflection of the material is about 90 per cent.) than that required for work on the darker materials used in the shops of the first class, with a co efficient of reflection from about 5 to 20 per cent. For sewing on coloured materials, the mid-point, above and below which there were equal numbers of observations, was 3·6 foot-candles; for cutting and pressing, 2 foot-candles; for sewing on white linen, 2·5 foot-candles; on the floors, 0·85 foot-candle.

Miscellaneous Industries.

In the seventeen unclassified rooms investigated, the systems of lighting encountered included batswing burners, inverted mantles, and electric incandescent lamps. Two drawing-office measurements taken showed an illumination of 5·5 and 3·7 foot-candles at the point of work. In other cases the mean illuminations in foot-candles at the point of work were: Cotton-bag making, 0·25; tapestry, 3·1; Christmas card printing, tying, &c., 8·2; print colouring, 8·4; printing, from 7 to 0·93; box making, 1·2; chocolate making and packing, 1·3; cocoa packing, 1·2; chocolate packing, 0·9; and burling, 7.

Fatality to a Gas-Fitter.—At an inquest held on the body of a Birmingham gas-fitter named Bradley, who was killed by an explosion of gas at the Midland Railway works, it was stated that deceased had recently been engaged with another workman in replacing two purifiers in the sheds. When the explosion occurred, he was hurled into the air, and killed instantaneously. Harry Cotterill, a mechanical engineer at the works, said the purifiers had been fixed and the pipes laid and practically completed when the explosion took place. He was called to the scene shortly after the accident, and saw deceased lying beside one of the purifiers. The cover of the purifier had been blown off, and the roof of the engine-house was damaged. On examining the pipes and the purifiers the following day, he found all the joints and connections were apparently in perfect order. He discovered a live match in a hole, and a box of matches similar to those supplied by the Company to the workmen was also found. Witness did not think it possible for the explosion to have occurred without a naked light. A verdict of "Accidental death" was returned.

THE DUTCH BUREAU OF COALS.

[From a Correspondent.]

One of the principal matters in Holland concerning gas supply is that the Bureau of Coals, to which allusion has more than once been made in the "JOURNAL," is about to disappear. There have many times been questions raised about the Bureau; and now the Minister of Industry has declared that the Dutch Government are about to take the distribution of coal under their own control.

From an independent point of view, it must be said that the Bureau has done its work well. The principal agitation against it came from a small number of so-called independent coal merchants, who were stopped in their endeavour to bleed the Dutch coal consumers by making unrestricted war profits. In his speech before the Chamber, the Dutch Minister reviewed the operations of the Bureau. Owing to its action, he said, not a single industrial enterprise in Holland had been in want of coal. Every consumer was in a position to make a contract for a reasonable period, and at fair prices. Through the action of the Bureau, coal prices fell 2 guilders per metric ton; and as the consumption has been 9 million tons, the gain to the Dutch consumers has been 18 million guilders, or £1,500,000. Though German and British interests are represented on the Bureau, it is perfectly Dutch in character. The interests of the importers and coal merchants have been taken care of in every way.

The inauguration of the Bureau in no way hindered imports from England. In the two months preceding its installation, the imports from the United Kingdom were 156,000 tons; whereas in the two months following, the imports rose to 400,000 tons. In every way, the Bureau is working to facilitate imports from the United Kingdom, and to ameliorate international conditions. But it must be acknowledged that the Bureau has been a great obstacle to those coal merchants who tried to make extra profits on coal; and these merchants have made the great noise concerning the Dutch coal trade. This small group are still busy undermining the position; and to make the future perfectly clear, the Dutch Government are now going themselves to take in hand the distribution of coal.

THE DEL MONTE PROCESS.

Fundamental Changes—A Colliery Orders an Installation.

The Del Monte process has made a passing reappearance in the columns of the "Engineer." The patents, as our readers are aware, are now in the hands of the Oil and Carbon Products Company, Limited; and for them Mr. Walter White, of coke-oven experience, has been studying the whole process, which, by the introduction of several fundamental changes, our contemporary says, "has now been brought to a position where it seems likely to have a good prospect of success." So far, however, only plant of an experimental kind, though on a full working scale, has been constructed. But a large plant has been ordered by a Midland colliery; and it is understood this is now being made. It will consist of several units of the general type.

In the experimental plant erected at Chiswick, the retort is a steel tube about 14 inches in internal diameter and some 20 feet long. It is almost horizontal, instead of inclined as in the original Del Monte form. Within this tube a worm, made of cast-iron segments fitted on a large tubular shaft, extends from end to end, and fits fairly closely. The worm is revolved very slowly by a ratchet arrangement and conveys the coal, shale, peat, &c.—introduced through a hopper, with a sealing valve—from the lower to the upper end. The retort is set in a brick-work oven, and is heated externally by bunsen flames for about one-half of its length. The worm itself takes up a great deal of heat, and conducts it to the part of the retort not heated externally. Hence the hottest end of the tube is that furthest from the feeding hopper, and the heat gradually diminishes, so that the fuel is subjected to a greater and greater temperature as it is carried forward by the worm.

Thus far (remarks the "Engineer") the plant resembles the Del Monte fairly closely; but a very important modification has been effected. In the old case condensation took place in the retort itself, with the result that the oil was generally dirty. Under the new arrangement it takes place in a separate tube removed from the fuel, and hence the oil is much cleaner. In the experimental plant this tube lies beside and a little above the latter. From the crown of the retort branch pipes (grouped at the cooler half of the retort) lead to the condenser. The result of using branches in this way instead of a single exit, is that zones of vapour, at different temperatures, are formed in the condenser; the zone nearest to the outlet end being the coldest. Hence the hotter vapours in their passage towards the exit are progressively cooled and condensed. The condensed oils are led away from the end of the condenser through a U-tube into a drum. The fixed gases are drawn out by a fan, scrubbed, and passed into a holder, whence a portion of them is led to the burners that heat the retort—the remainder being available for other purposes.

Proceeding, our contemporary says: From this description it will be understood that, in general terms, the process consists in the low-temperature distillation of oil-bearing material by means of graduated heating in a neutral atmosphere, the vapours given off being at once conveyed to a cooler zone without a chance of being split-up by contact with heat, and recovered exactly as they leave the material under treatment. In this way there is obtained a high yield of good quality oil free from impurities. Coals give from 20 to 40 gallons of oil per ton and cannel from 80 to 100 gallons per ton; the product being very similar to a light tar, with a specific gravity of 1·05. In view of the great quantity of oil that can be recovered from cannel, plants of this kind find their chief field in the cannel districts of Lancashire, Scotland, and Wales.

A unit of the plant consists of two retorts placed side by side, with one condenser between and above them. The two retorts will work as one, being charged and discharged at the same time and by the same mechanism. The retort tubes will be 18 inches internal diameter and 20 feet long, and the pair will deal with about 10 tons of coal per day of twenty-four hours. The plant, of course, would work continuously night and day, week in and week out. The coal will be brought by suitable conveying plant up to a battery of such units, and discharged into the hoppers.

From tests made at the experimental plant with the Midland coal, for which the first commercial plant is being constructed, it was found that 21 gallons of oil with a specific gravity of 1·045 were obtained. The oil gave the following products on further distillation:

	Deg.	Per Cent.	Sp. Gr.	
Light oil . . .	170	. 5·3 ..	·85 ..	Yellow brown.
Second light oil.	170–230	.. 12·6 ..	·95 ..	Liquid red brown.
Heavy oil . .	230–270	.. 14·8 ..	·988 ..	Liquid dark red brown.
Anthracene oil .	Above 270	.. 30·0 ..	1·005 ..	Viscous dark yellow brown.
Pitch	85–90	.. 34·0 ..	1·134 ..	—
Loss . .		.. 3·3		

GAS SUPPLY TROUBLES AT RIPON.

It was briefly mentioned in the columns of the "JOURNAL" last week that, owing to the heavy increase in the consumption of gas at Ripon consequent on the presence of the military, great difficulty was being experienced in maintaining a supply at all. When practicable, the productive capacity of the works is to be increased by the provision of additional retorts; but meantime the shortage of stokers has become so acute that an appeal has been made for voluntary helpers. The work of raising a corps of volunteers for this work was entrusted to Councillor T. F. Spence, who, in reply to a circular issued, received a satisfactory response from citizens willing to help the Gas Committee out of their difficulty. In due time, Mr. Spence, along with Mr. Brown (the Chairman of the Gas Committee), and three others, started work on an eight-hour shift, as gas stokers; and arrangements were being made to continue this voluntary assistance until the present labour troubles had been met.

A meeting of the Council was held—at which the gas was aided by oil-lamps and candles—when the Gas Committee submitted a report by Mr. Matt. Dunn, of Stockton, upon the present state of the works, and advocating that the Corporation should carry out certain additions and improvements, the estimated cost of which was about £7400. The scheme included the installation of vertical retorts of a capacity of 250,000 cubic feet per day. This recommendation will be considered by the Committee. The voluntary labour at the works was somewhat criticized; and one member declared that if the Council had not tinkered so much with the wage question they would have obtained qualified stokers. Mr. Brown (the Chairman of the Committee) replied that the works were getting old; and unless something was done, and done quickly, the city would be in darkness.

LOCAL AUTHORITIES AND THE TOLUOL QUESTION.

A Committee of the Kensington Borough Council, "in view of the fact that the removal of all checks on the quality of the gas supplied, as suggested by the Ministry of Munitions, will be solely to the interest of the Gas Company, and entirely to the detriment of the Council and the private consumers of gas in the borough," recommend that a communication be addressed to the London County Council stating that the Council disagree with the suggestions; and that other Metropolitan Borough Councils be requested, in the event of their agreeing with the views set forth, also to communicate with the London County Council on the lines indicated.

Having considered the letter from the Ministry of Munitions with reference to the position of the gas companies who have undertaken the work of extracting benzol and toluol for the making of explosives, the Works Committee of the Westminster City Council state that, while in the circumstances they think no obstacle should be put in the way of the Government obtaining the products referred to from the manufacture of gas, it appears that, as such products will presumably be sold by the gas undertakings at a profit, an allowance should be made to consumers, in respect of any deterioration of the lighting or heating qualities of the gas consequent on the extraction of these products. The Committee recommend that representations to this effect be made to the Ministry of Munitions and to the Gas Light and Coke Company.

Replying to questions addressed to him by members at a meeting of the Richmond (Surrey) Corporation, in reference to the letter from the Ministry of Munitions, stating that gas companies will be relieved of any penal consequences in case the standard of illuminating power or calorific value is not maintained, owing to the extraction of benzol, toluol, &c., the Chairman of the Highways Committee said it was considered advisable to continue the tests of the gas supplied by the local Company, so as to have them ready for reference at any future time. The salary of the gas tester was £40 per annum. Alderman Bisgood said that the products would be sold; and he asked whether it was thought fit to request the Company to reduce the charge for gas to the extent to which it might be deprived of its lighting and heating value. Alderman Simpson pointed out, however, that there was the arrangement under which, if the Company paid a higher dividend, the ratepayers got the benefit of gas at a lower price. Alderman Edgar said he did not see the use of the tests, and thought that the gas tester would be better employed in work for the Government. Alderman Simpson promised to bring the points raised to the notice of the Committee.

Over 250 employees of the Consumers' Gas Company, Toronto, have enlisted and are now serving with the Colours at the front, or are about to leave for overseas service.

EXPORTS OF SULPHATE OF AMMONIA.

The agricultural correspondent of the "Times," in the course of an article which appeared in that paper on Monday of last week, on the subject of "Feeding Stuffs for Neutrals," contended that, if the farming interests of our own country received the consideration they are entitled to, not a ton of fertilizers or feeding stuffs would be allowed to be shipped until all home requirements were fully met. He said: "To take the case of sulphate of ammonia, the British farmer is seriously affected by the exportations to Holland which the Government have sanctioned. The position is certainly remarkable. In normal times, our yearly shipments to that country amount to from 3000 to 3500 tons. An American trade publication states that 'early in October export licences were granted for Holland to the extent of 5000 tons per month;' and there is confirmation of this in the fact that the November shipments totalled over 4000 tons. The action of the Government suggests greater solicitude for the needs of neutral countries than for those of the United Kingdom. The quantities that are allowed to go abroad—especially of sulphate of ammonia—do not consist entirely of surplus production, but, in the absence of imported substitutes, are deducted in part from the requirements for home use. There is proof of this in the disorganized state of the markets and the increase in the price of our native nitrogenous fertilizer, which is 50s., or more, a ton above the October level."

These remarks were replied to in the "Times" on Wednesday by Mr. F. D. Acland, who pointed out that he is the Chairman of a Committee appointed by the President of the Board of Agriculture and Fisheries to take such steps as may be possible and advisable to ensure an adequate supply of fertilizers for the use of farmers. Admitting the justice of the contention that the farming interest has a right to claim that not a ton of fertilizers or feeding stuffs should be allowed to be exported until home requirements are fully met, he says that this is precisely the policy which the Board of Agriculture have adopted since the outbreak of war. Mr. Acland then proceeds: "It would be of interest if the correspondent would indicate more clearly what he means by a full provision for home requirements, particularly in the case of sulphate of ammonia, which he selects as an example. The normal output of sulphate of ammonia is about 400,000 tons per annum, and the normal exports are about three-fourths of the total; a considerable proportion of the remainder being used for industrial purposes. Is it suggested that farmers would use what must be considerably more than four times their usual quantity if exports were entirely prohibited? This would involve their spending about six million pounds on this one artificial manure—which is really unthinkable in the present agricultural circumstances. Or is it suggested that the same quantity would be produced if the market were restricted to the home demand? It is true that sulphate of ammonia is to a large extent a bye-product of gas making. But I understand that it is possible to make gas and at the same time considerably to reduce the production of sulphate of ammonia, and that this might be done if the supply were to exceed the demand over any considerable period. In that case, the price of gas would rise, and the farmers would get no more fertilizer. This aspect of the matter is worth consideration by those who advocate prohibition of export not so much in order to secure ample supplies, but in order to lower prices. The effect of prohibition of export upon the Scottish shale-oil works and the coke-ovens of the North of England ought also to be considered. Subject to the farmers' supplies being ample, the position of such industries is surely a matter for thought and attention. With regard to supplies, the Committee propose to act in the future on the same general lines as in the past—namely, by an arrangement with the makers of sulphate of ammonia to reserve month by month an ample supply for agricultural requirements, and to assent to the export from time to time only of such quantities as are shown to be in excess of all home demands. Farmers have an entirely reasonable expectation of being able to obtain during the coming months an ample supply of all fertilizers which can be produced here in sufficient quantities. This expectation should not be encouraged to degenerate either into a groundless belief that such supplies will not be available, or into an unreasoning demand that all exports should be stopped—however ample the supplies may be which will be retained here."

On Thursday, the "Times" published the following letter on the subject, from "Agricola": "Mr. Acland, the Parliamentary Secretary of the Board of Agriculture, asks what is meant by a 'full provision of sulphate of ammonia for home requirements of farms.' The Board of Agriculture themselves have circularized farmers in regard to wheat growing, advising them to put on 2 cwt. of sulphate of ammonia per acre in order to get an increased yield of about 25 per cent. If this is to be done, it will require about 200,000 tons. The time to put it on would be, in two doses, about March and April. The point I tried to make in my previous letter was that the Government should see that a big quantity was available, and that the farmers did put it on for the nation's benefit. As to the price the farmers should pay, if it were not for the anti-Protection attitude of Mr. Acland and the majority of the Cabinet, I believe that in this emergency the Government would have been wise even to go as far as presenting the farmers with the material by which they could increase England's output of food by 25 per cent., and thus save us being at the mercy of submarines and of foreign high prices and of the ever-increasing huge freights. Anyhow, by preventing the export of sulphate of ammonia, we might hope to see prices kept down to about the £10 at which it was quoted July, 1914, instead of £16, which is the current price for English consumption. I would also point out that Lord Selborne admits that he has failed to induce the Government to import nitrate of soda in Admiralty transport vessels; and the farmer will thus have to do without this fertilizer next spring. Even if he could have got it, it does seem ridiculous that, after freights have been allowed by bad Government management of our shipping to run up to £5 or £6 a ton of nitrate of soda from Chile, ships should be occupied in bringing over this nitrate to England, while other ships are carrying nearly 300,000 tons of sulphate of ammonia from England to the ends of the world, when all the time the sulphate of ammonia could be used to replace the nitrate of soda in English agricultural practice—thus saving both journeys. As a large farmer, I feel forced to express very strongly my view that England's interests are not being looked after, and that the foreign countries getting our sulphate of ammonia are deriving undue benefits."

In the same issue, Mr. Roger W. Wallace, after remarking that Mr. Acland's letter showed how supine are those who direct our explosives departments, said: "The sulphate of ammonia exported to Holland is not for agricultural purposes, but for the manufacture of high explosives in Germany. The stocks of materials for producing nitrogen for explosives are very low; and it is difficult for German manufacturers to find. They cannot get nitrate of soda as we can, and are limited to nitric acid made from the atmosphere by electrical processes. This is done in the neutral countries, Norway, Sweden, and Switzerland, but in Germany only to a very small extent, as they have practically no water power. Some years before the war the German authorities recognized this, and gave large premiums to chemists to work out processes for changing ammonia into nitric acid. This they succeeded in arriving at; and it is for this purpose the sulphate of ammonia Mr. Acland advocates being allowed to go to Holland is to be used. The Germans may find substitutes for cotton; but they cannot now make at a reasonable price nitric acid in any other way than from ammonia. The President of the Board of Agriculture announces that nitrate of soda cannot be obtained from Chile because of the exceptional demands for freight. If this is so, why not let the farmers have cheap the 'Holland' sulphate of ammonia, which is in nearly every case in agriculture an equivalent for nitrate of soda?"

The next issue of the "Times" (that for Monday) contained the following letter on the subject written by Mr. D. Milne Watson, in his capacity of Chairman of the Sulphate of Ammonia Association: "Allow us to state that we are reserving enough sulphate of ammonia to supply British demands for nitrogen, even supposing that not one single ton of nitrate of soda is shipped. As regards the price, it is true that £10 was accepted in July, 1914; but this was due to artificial depression in the market brought about by the manœuvres of the German Syndicate. A fair average pre-war price for sulphate of ammonia was £14 per ton. Owing to the war our costs of manufacture have risen by over £3 per ton; so that we are not making a penny per ton more profit at present prices than we were before the war. These facts will give agriculturists the measure of the sacrifice which manufacturers of sulphate of ammonia have agreed to accept in selling at £14 10s. for autumn dressing. We agreed to take this burden upon ourselves in order to encourage farmers to make the experiment of applying sulphate to autumn wheat—a practice which has been attended with very successful results on the Continent. If the experiment is a success, we recognize that our outlet in the home market should be considerably increased in future years. If the Government wish to intervene, we are willing to reduce the price of sulphate of ammonia by £1 per ton for every £1 by which the cost of manufacture is reduced. The Board of Agriculture have, however, in the past persistently ignored sulphate of ammonia, and recommended nitrate of soda—a foreign product. But we may say that, as far as the supply is concerned, the Board have now taken all the necessary steps, in conjunction with ourselves, to secure the supply to agriculturists. We should be only too pleased to be able to sell the whole of our production at home; and we shall be highly gratified if even double the normal quantity of 60,000 tons is used this season. As regards Holland, your correspondents appear to be unaware of the fact that in normal years Holland has been a large buyer of German sulphate of ammonia which she is now, of course, unable to obtain. In addition to this Holland consumes a very large quantity of nitrate of soda, which she has been unable to obtain this year. It is, therefore, perfectly natural that she should wish to replace these deficiencies by buying British sulphate of ammonia. The arrangement by which sulphate of ammonia is now being exported to Holland in limited quantities was made at the direct request of the Dutch Government, and that Government has no doubt satisfied our Government concerning the uses to which the sulphate will be put. Mr. Roger Wallace has apparently not heard of the success of the Haber process in Germany, and implies that synthetic nitrogen is only being made to a large extent in neutral countries. The facts are otherwise. The Badische Company are at the moment, according to their own account published in German newspapers, producing at the rate of 300,000 tons of sulphate of ammonia per annum; and in view of the increase in the production of cyanamide in Germany, it seems more than probable that the German claim that they are independent of nitrogen from outside sources is perfectly correct."

On the same day, another correspondent—Mr. Christopher Turnor—wrote in these terms on the matter: "Mr. Acland's letter will bring small comfort to the practical farmer at present requiring sulphate of ammonia and other artificials. His argument is that we agriculturists do not really understand the situation in regard to artificials—not having the inner information which is at the disposal of the Board of Agriculture. But I think we have quite sufficient evidence at our disposal to entitle us to reject Mr. Acland's contention that there is so much sulphate of ammonia in the country that the manufacturers thereof must export large quantities or else reduce their output. The chief point to understand clearly is that, as the Board of Agriculture itself admits, there will be a serious shortage of nitrate of soda. Sulphate of ammonia is the only alternative nitrogenous artificial. My own practical experience is that at this moment it is very hard to get quotations for sulphate of ammonia at all; and such quotations as I have received are at £16 10s. and £16 15s. a ton. This does not bear out the contention that there is a superabundant supply. At this time last year the price was £12 10s. a ton. Mr. Acland cannot conceive how our farmers can possibly use an extra £6,000,000 worth of sulphate of ammonia. For myself, I see nothing impossible in their doing so, if the supply of nitrate is greatly reduced, and if our farmers begin to use artificial manure at all to the extent that it is used on the Continent. The Board of Agriculture have attempted to encourage farmers to use sulphate of ammonia by saying that they shall have it at £14 10s. a ton if they use it as an autumn top-dressing for wheat and apply it before Dec. 31. Now there are two considerations that make this limitation unreasonable. First, in many parts of England the wheat crop is unusually backward, and for some time back

the land has not been in a condition permitting the application of the sulphate. Secondly, in Denmark, where the use of artificials is very thoroughtly understood, the top-dressing of sulphate is often applied as late as April. In spite of all that Mr. Acland has said, I feel the large export of sulphate of ammonia to be most unwise. I quite understand that the Government is anxious to export any and every thing it possibly can; but this policy must not be carried out at the cost of lessening production in this country. A further point is that the larger amount of this exported sulphate goes to Holland; and even if this is all actually used in Holland itself, it is employed for growing food which is exported to Germany."

A letter referring to the original statements in the "Times," written by Mr. D. Milne Watson, the Chairman of the Sulphate of Ammonia Association, appears in our "Correspondence" columns to-day.—ED. J.G.L.

Fatality at the Dudley Gas-Works.—The Jury returned a verdict of "Accidental death" at an inquest on the body of Walter Crow, yard foreman at the Dudley Gas-Works. Deceased and a labourer were engaged in removing bricks from a wall at the works, in order to release some coal behind it, when the wall and a brick pillar suddenly collapsed, killing Crow instantly.

Humphrey Pump Company.—The Directors, in their report for the twelve months to Sept. 30, regret that the war continues to seriously affect the business of the Company. The Company's claims in connection with the large pumping contract at Mex, Egypt, have not yet been finally settled. Certain outstanding contracts have been completed. Installations have been set to work in Italy and India by licensees. The principal work accomplished has been the development of a new type of pump more suitable for manufacture in small sizes, leaving the original Humphrey pump for large installations. Notwithstanding the exceptional call made upon their time and attention by the Company's affairs during the year, the Directors have, owing to the war, decided to forgo their fees for the year.

Bilston Gas Company.—The Directors' report for the year ended Sept. 30 states that the profit and loss account, after paying the usual interim dividends, shows a credit balance of £15,986. It is proposed to pay further dividends of 5s. 6d. per share on the "A" shares, less tax, and 4s. per share on the "B" shares, less tax (making, with the interim dividends, 11s. and 8s. per share respectively, less tax, for the year), leaving thereafter a balance of £13,648. In consequence of the increased cost of fuel, &c., the Directors were compelled to raise the price of gas 3d. per 1000 cubic feet to ordinary consumers, and other rates in proportion, as from Sept. 30 last. This increase in price will not, however, cover the increased cost of manufacture; and unless the price is still further advanced, it will probably be necessary to draw upon the balance carried forward for maintaining the customary dividends next year.

EFFECT OF GAS UPON ORGANS.

Reference has been made in the "Bulletin of the British Commercial Gas Association" to the good work that has been done in regard to alleged damage caused by gas-radiators to organs, and the way in which it has been found possible to so completely turn the tables as to get gas employed for the preservation of organs from damage by damp. The matter originated with a letter in the "Musical News" last year, in which the writer laid the blame for ciphering troubles and the corrosion of the metal work in an organ on gas-radiators with which the church concerned was heated. This complaint the Association made the subject of a careful investigation; and at the same time an experiment was started at another church in London, where similar trouble had arisen. The result of this work was set forth in an article published in the "Musical News" for Sept. 4 last, which the Association have had reproduced as a pamphlet, together with some gratifying testimonials to the use of gas-fires in rooms where there are pianos.

The "Musical News" says the complaining letter which appeared in the first place did not produce much effect, judged by any correspondence it called forth; but as its statements seemed on the face of them to challenge the desirability of having gas-radiators in a building where a large and expensive musical instrument stood, it attracted the notice of the British Commercial Gas Association, with whose representative they had an interview. He assured them that the trouble could not be caused by the gas-steam radiators, as there were very many churches so heated from which no complaint had been received; and he pointed out that ciphering and the other troubles mentioned were experienced long before any form of gas heating had become common in churches—in fact, they still occur where no gas is used either for lighting or heating. The remainder of the article is given in our contemporary's own words.

EXPERIMENTS IN SEARCH OF A REMEDY.

There was force in this contention, and taking into consideration the interest of the subject to a large proportion of our readers, we invited the representative of the Association to place his views before them; but he said that those connected with the gas industry were giving the problem close attention. Experiments were actually in hand with a view to demonstrating that—whether gas or any other form of heating was or was not the cause of such troubles—gas could, if properly applied, prove a certain remedy for them. In these circumstances, we withheld any comments on the matter until these experiments were completed. After nearly a year and a half, definite and reliable results have been obtained; and as the whole subject is one of great importance to churches and organ-builders, as well as to organists themselves, we are glad to refer to them in detail.

The gas engineers who conducted the experiments set themselves the task, first of discovering the cause of the evil, then of designing

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a simple apparatus for its prevention. Their report has been placed in our hands; and it runs to the following effect.

It has been found by experience that many pipe organs, no matter what system of heating or lighting is in use in the buildings in which they are installed, suffer materially in the following way. The metal parts are subject to fairly rapid corrosion, especially the wires and similar working parts, and the stops and pneumatic pistons are apt to stick. The effect of this action is to materially lessen the beauty and regularity of the music obtainable from the instrument. It also necessitates more frequent repairs to the organ, and materially shortens its life.

It has been clearly proved that the cause of the above-mentioned defects is the fact that in churches and similar buildings which are not in constant hourly, or in many cases even daily, use, or when used are frequently only partially so, the temperature of the air and the surroundings in the inclement seasons of the year drops to a very low point during the period when the building is either entirely unused or is not in full use. Dampness is also experienced in some cases. When the building comes into use, some form of apparatus for its general heating is started—usually some little while before the congregation or audience enter the building. The temperature then rises fairly rapidly; and the effect of this, and the heat and moisture arising from the congregation or audience when they assemble, is to cause air containing moisture, and at a temperature materially greater than that of the organ itself, to come into contact with the metal wires and plates, wooden stops, and other working parts of the organ. This causes condensation to form on the metal, and oxidization, &c., to ensue, causing the subsequent corrosion of the metal. In addition to this, owing to the fairly sudden changes in temperature during heating or cooling off, uneven expansion and contraction take place according to whether the parts are metal or wood. Stops and pneumatic pistons are also affected, and have a tendency to stick.

The result, from a musical point of view, is that, owing to the sticking of the stops, &c., and the corrosion of wires which pass through similarly corroded metal plates, the instrument does not give forth the perfect intonation and effect that the organist desires, and ciphering frequently takes place owing to a wire or wires acting in one direction, but failing to return owing to the jamming of the corroded wire or wires in the corroded metal plate. Destruction and breaking of wires also occur far more rapidly than is warranted by fair wear and tear. The corrosion is usually materially accentuated by the fact that the air of the average town contains a proportion of sulphur, which, when deposited on the metal with moisture, hurries the corrosive process.

It has been discovered that a means of preventing the trouble herein explained is to keep a constant stream of warmed dry air passing over the internal parts of the organ during the inclement months of the year, so that the temperature of the organ and these internal parts is always kept above that of the general air and the contents and structure of the other parts of the building—indeed, if necessary, it would thereby be possible always to keep the air in and around the organ at what may be termed normal summer temperature. When such a system is properly carried out, the organ remains quite unaffected by the rapid and extreme changes in temperature previously explained; and the consequent dryness, absence of corrosion, and absence of repeated expansion and contraction of the parts improve the tone, life, and working of the organ.

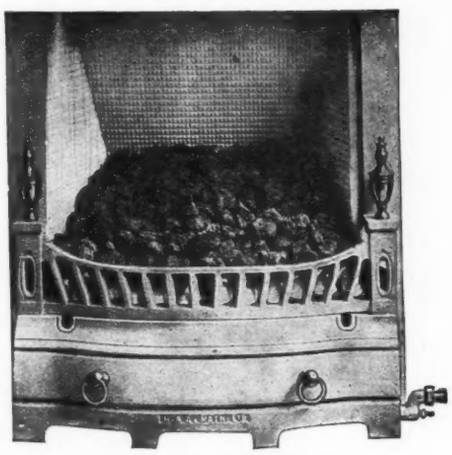
It would seem at first sight as if the suggested remedy called for an elaborate scheme of heating and ventilation, or at least one of some magnitude, in respect to primary cost and the subsequent annual running cost. It is claimed, however, that this was not the case; and by the courtesy of the authorities of the New College Chapel, Upper Avenue Road, London, N.W. (where the gas experts were carrying out the experiments mentioned above), we are able to describe an apparatus which, after having been in use the whole of last autumn and winter—a particularly damp season—has proved to have achieved the desired result. The apparatus in this case is heated by ordinary coal gas, which is very economical and easily regulated; but when this is not available, the same results can be obtained by the use of acetylene gas, petrol gas, or even electricity, or oil.

A Simple Gas Heating and Ventilating Apparatus.

For the purpose of generating and inducing a constant stream of warmed, dry air to pass over the working parts of the organ, the engineers constructed two special air-heaters with flues running into the organ—one at the front and one at the rear—in order more evenly to distribute the warmed air, and thus reach all material parts of the organ. The air which comes into contact with the exterior of these flues is also warmed slightly, thus assisting the process. Owing to the construction of the air-heaters, the warmed air contained in, and delivered by, the flues does not pass through the chamber containing products of combustion from the heating agent.

The air-heaters, which are made of iron, are constructed as follows: They are each divided into two separate chambers by a plate, and have holes perforated in the front of the upper chamber, from the upper part of which the flues are led into the organ. The lower chamber contains a very small gas-burner of the atmospheric bunsen type. When this burner is ignited, it heats the dividing plate and also the upper chamber above it; and when the upper chamber becomes thoroughly hot, an upward movement of the heated air inside takes place. This air passing away through the flue causes a current of fresh, unwarmed air to be drawn through the holes in the upper chamber, which air is duly warmed, and, in its turn, passes away into and through the flue. This movement of air continues during the whole time the apparatus is working or being heated, and ensures the constant stream of warmed, dry air passing into the organ as previously described. The distributing ends of the flues are preferably enlarged

THE MAIN GAS FIRES.



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and made oval or trumpet-shaped in order to give a greater width of spread to the discharge of warmed air.

The air-heating apparatus and air flues are perfectly safe, and were passed by the Fire Insurance authorities—a point of importance, of course. They can also be easily masked or hidden, in order that they shall not be noticeable or unsightly, and they are not obtrusively large. At the New College Chapel one of the heaters is placed on the left of the organist, and can quite conveniently be enclosed. The other one is entirely out of sight—being at the rear of the organ.

Moderate Running and Installation Costs.

Naturally the first doubt that will arise is concerning the cost. This has proved to be quite moderate, as the quantity of gas consumed hourly is very small. The chapel authorities were recommended to leave the gas constantly burning in the heaters from early October to the end of April—a period of seven months. It was estimated that at the pre-war price of gas the cost would amount to about £7 for the whole winter season; but notwithstanding that the price was subsequently raised, it was found that the whole cost came to a trifle under £5—the gas being 2s. 8d. per 1000 cubic feet. There are two other points. Besides the current cost, What was the expense of the heaters and the installation? This, we are informed, in the case mentioned amounted to less than £10.

A Great Improvement.

Then, What has been the effect on the organ itself? This is really the crucial point; and it is therefore satisfactory to hear that the organist and all concerned bear testimony to the great improvement of the organ since the apparatus was installed; while there is no trace whatever of corrosion in the action. Here and there there is some dryness, which may necessitate a little lubrication before the wet season sets in; but in these experiments this really was the result desired, as in the past the difficulty has been the effect of moisture. In this respect, it may be pointed out that excessive dryness is almost as bad an enemy as excessive moisture; but with so low an expenditure of gas, this is not very likely to arise; and, in any case, no doubt the attention of gas engineers can be directed towards obviating it. A point worth mentioning is that the constant heat generated is of some, though possibly slight, value towards the general warming of the building, apart from its special application in connection with the organ. We understand the apparatus has been provisionally protected.

Summary.

To sum up, the cause of organ troubles is primarily the extreme variations of temperature, due not only to often-marked changes in the natural atmosphere, but to the irregularity of heating methods. It is no unusual thing for a church to be heated on Sunday to 60° or more, which in the middle of the week falls nearly to freezing point. In our youth we often practised in woollen gloves, in order to retain consciousness of our fingers, whereas on a Sunday it was necessary to remove one's overcoat. If the deleterious effect of these variations can be prevented by the installation of an apparatus which is both cheap to set up and inexpensive to maintain, it is surely worth the notice of church authorities and organ-builders. Too often a costly instrument is erected, and left to its good behaviour, so to speak, with very inadequate attention beyond regular tuning, perhaps once a quarter, perhaps oftener. We feel sure that any device which ensures a steady temperature would add to the life and efficiency of the instrument, and would in the long run justify its cost.

It may be added that the apparatus for keeping the organ dry is being made by the Davis Gas-Stove Company, Limited.

JARROW RAILWAY ACCIDENT.

Gas Lighting in Trains.

The terrible railway accident which occurred last Friday week near Jarrow, when at least seventeen persons lost their lives as the result of a collision (the remains in sixteen cases being so charred that identification was a difficult task), has led to renewed discussion in some of the newspapers of the subject of gas lighting for trains; and this aspect of the matter was also referred to in the course of the evidence given during the Board of Trade inquiry by Colonel Von Donop, at Newcastle-on-Tyne.

Alexander Mitchell, the guard of the passenger train mainly involved, said that after the collision he left his train to summon help, and on returning found the leading vehicle of it was on fire. He did not know whether any other portion of the train was on fire at the time. He thought that gas was escaping. The five rear vehicles were uncoupled and drawn away. Another guard, named Robert Taylor, said he thought it came from the roof lamps of the carriage, as the roof was alight and not the lower part. At the time he did not see anyone attempting to extinguish the fire. The rear vehicles were uncoupled; but he could not exactly say why he did not take steps to uncouple the third vehicle, which was not alight. He saw no passengers in the leading or the second vehicle. There were no lights on his train. They were all put out at Hebburn.

Sampson Talliday, an engine driver, who was a passenger in the train, stated that he was in the second compartment of the second vehicle. After he had managed to get out of it, he set to work to liberate the passengers from the compartment in front of his. Two passengers who were alive, and one who was dead, were left in the compartment. While he was working, he noticed a small jet of fire rising from the top of a gas-cylinder under the carriage in which the people were imprisoned. He at once sent three men to fetch the fire extinguishers which he knew would be on the train. Witness left

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the passengers and went under the carriage to try to put out the fire, but without success. Finding that he could not extinguish the flames under the carriage, he went round to the other side of the compartment, where he knew the passengers were fast. He tried to extinguish the fire there, but failed to do so; and by that time the flames were spreading rapidly to the top of the carriage, and the people inside began to shout. He was unable to say what caused the jet of flame under the carriage; but he did not think it was due to the ashes from the engine. Witness went on to the top of the carriage, and played on the fire with an extinguisher; but it had no effect.

Mr. A. C. Stamer, Acting Chief Mechanical Engineer of the North-Eastern Railway Company for the construction of rolling stock, gave evidence regarding the lighting arrangements of the two vehicles. The gas was carried in three cylinders in the case of the leading vehicle, and by four cylinders in the second vehicle, which was partially burned. The vehicle of the other train which was burned also had three gas-cylinders. The cylinders were placed underneath the vehicles, and well up into the frame. One of the cylinders was found knocked off the coach, and lying at the rear of the engine. It was the cylinder at the leading end of the first vehicle. On examination it was found to be burst at both ends. The back of the bunker of the engine was badly scorched. He thought it was due to the proximity of the burning coach, and not necessarily to gas from the cylinder. Owing to the cylinders being burst, he considered the gas quickly escaped. Witness further stated that the other two cylinders were found in position on the coach. One was delved in at the bottom; but he did not think it was split. The other was burst away at both ends. The pipe connections were broken away from all the cylinders. In regard to the cylinders of the second vehicle, all were in order, and in position; and only one connection was broken. This was the leading right-hand cylinder of the four. All the low-pressure pipes, however, were severed and burst. Two of the cylinders of the leading vehicle of the down train were in good order, and in their proper positions on the train. The other one was in position; but it was burst at one end. The cylinders were not fitted with safety valves. His Company had made one or two trials with different sorts of automatic valves, having for their object to prevent the rush of gas out of the cylinders if any of the pipe-connections were severed. The result of the experiments with these valves was, however, unsatisfactory. They were found to be unreliable, and not to shut-off as they were supposed to do. The Company were still making experiments.

The INSPECTOR: Have your Company taken any special steps within the last few years to take precautions against fire on trains?

Witness: Yes, we have gone into the question.

Will you kindly tell me what steps you have taken?—We have fitted 770 vans with rescue appliances and fire appliances. That is out of a total of 836 vans which we propose to fit up. We have also fitted 924 with a lead pipe on the low-pressure side of the gas-regulator—that is the pipe which runs up the outside of the end of the vehicle to feed the lamps.

What was the object of that?—The object is that if there is a rupture of the pipe it can be readily closed by means of a hammer. This could not be done in the case of the old steel pipes.

Proceeding, witness said that since the Company introduced incandescent gas they had found that they could reduce the number of cylinders under each vehicle, and, in order to obtain twenty-four hours' lighting, they found that they could reduce the number of cylinders in most of the vehicles to one—thus doing away sometimes with two, and sometimes three cylinders. They had altered 334 vehicles in this respect. Having regard to the condition of the cylinders after the accident, his own opinion was that it would be a very short time before all the gas was out of the cylinders. In fact, in the first coach which was burnt out, there was only one cylinder which was not ripped open, and from which the gas would have to escape by means of the connection on the cylinder.

William Dunlop, a guard, said the fire originated in the front part of the carriage, and the flames seemed to rise up from the bottom through the wreckage.

The inquiry is to be re-opened when the engine-drivers of the trains are ready to give evidence.

The inquest was opened at South Shields on Monday last week; and after evidence of identification had been given, the proceedings were adjourned until Jan. 18.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Dec.* 24.

In view of the holidays, the tar products market has been extremely quiet, and without alteration in prices.

Sulphate of ammonia is very strong; and £17 5s. net per ton in buyer's bags, *ex* maker's works, has been paid for 25 per cent. quality.

Tar Products in the Provinces.

Dec. 24.

There is nothing fresh to report concerning the market for tar products. Pitch is still in the same unsatisfactory position, and, owing to the shortage of tonnage, contracts cannot be arranged. Creosote is quiet, with little or no business doing. Solvent and heavy naphthas are in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 18s. 6d. to 22s. 6d. Pitch, East Coast, 15s. 6d. to 16s. 6d. per ton; West Coast, 15s. to 15s. 6d. Manchester; 16s. to 16s. 6d. Liverpool; 17s. to 18s. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 2s. to

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Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Dec.* 24.

Throughout the week the market for this article has continued on its upward course without any check, and a fresh record has been established in high prices since the year 1883. The nearest values at the close are £17 5s. per ton f.o.b. Hull, £17 12s. 6d. f.o.b. Liverpool, and £17 17s. 6d. f.o b. Leith. There has been good inquiry in the forward position, and it is reported that business has been done at the principal ports at £17 17s. 6d. per ton for January-March delivery, £17 10s. April-June, and £17 5s. July-December.

Nitrate of Soda.

This market has become quieter, but values are fairly well maintained at 15s. 3d. per cwt. for ordinary, and 16s. 3d. for refined quality, on spot.

Sulphate of Ammonia.

From another source, it is stated that the market for this article still continues upward; and it is reported that very high prices are being paid for delivery over the whole of next year. Outside London, makes are quoted at £16 5s. to £16 7s. 6d.; Hull, £17 2s. 6d. to £17 5s.; Leith, £17 5s. to £17 7s. 6d.; Middlesbrough, £17 2s. 6d.

COAL TRADE REPORT.

Northern Coal Trade.

The northern coal trade is active, but the demand for Admiralty purposes is heavy, and there is little fuel free for sale for a fortnight or so. In the steam coal trade, the output is well taken up, and forward business is not very easily entered into at present. Best Northumbrian steam coals are nominally about 22s. per ton, with little for prompt sale. Second-class steams are 20s.; and steam smalls are higher at 11s. to 13s. 6d. per ton, according to quality—all f.o.b. In the gas coal trade, the shipments have been full; but the holidays intervened, and the production will be only limited till after the turn of the year. Quotations are a little varied. For best Durhams, about 21s. to 21s. 6d. per ton f.o.b. may be put as the current price; second-class gas coals are near 19s. to 19s. 6d. per ton; and "Wear Specials" are firm at 21s. to 22s. 6d. per ton f.o.b. The smallness of the prompt supply, and the fact that on the long contracts the deliveries should now be at the heaviest, make these prices largely nominal, and probably little new business is being done for early delivery. Forward contracts are often in negotiation at the turn of the year; but there is not much heard of any, and the high freight has its effect. For gas coal, Tyne to London, the freight is about 15s. at present, though much coal is being carried on long contracts at considerably lower rates. Coke is firm, and rather scarce. The production of gas coke is heavy; and the price is about 28s. to 30s. per ton f.o.b. in the Tyne. But the high freights keep down the exports of coke also.

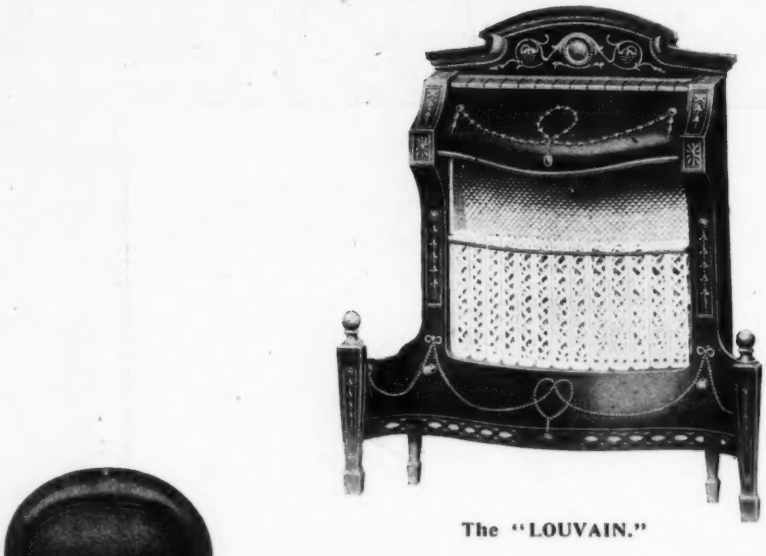
Sale of Shares.—At a local auction sale recently 500 shares of £1 each in the Woodbridge District Water Company were disposed of at prices ranging from 13s. 6d. to 14s. 3d. per share. The rate of interest paid on the shares last year was 3½ per cent.

Lighting of Athens.—The "Times" correspondent in Athens states that the shortage of coal for lighting purposes has caused measures of severe economy to be taken; and the Government have ordered a reduction in the lighting of the city by one-half. The announcement on Christmas Eve of the arrival of 6000 tons of Newcastle coal was received with satisfaction.

European Gas Company, Limited.—The Secretary of the Company (Mr. W. B. Brady) intimates that the Directors have decided to pay on Feb. 1 the same interim dividend as last year—10s. per share, free of income-tax. Until the accounts are made up for the financial year, it is impossible for the Directors to estimate how far the profits of the Company will be affected by the war, and what the amount of the final dividend will be.

Lighting Matters at Hendon.—The Hendon Rural District Council are continuing negotiations with the Harrow Gas Company, with a view to obtaining a reduction in the annual charge for street lighting. It was stated at the last Council meeting that the Company were now receiving for maintenance 2s. per month per lamp on the 224 lamps in the parish of Pinner. Upon this being pointed out to the Company, a letter had been received stating that as practically the whole of the lamps were unlighted in the district they could not reduce the charge. The Surveyor remarked that, under the present arrangement, the Council were paying £268 a year for nothing at all.

Maximum Coke Prices.—At a meeting at Cardiff last Wednesday of the South Wales Coke Manufacturers' Association, it was reported that a deputation had had an interview at the Ministry of Munitions in respect of a proposal to fix maximum prices for coke with a view particularly to ultimately bringing down the price of steel. The deputation stated they had agreed with the Munitions Department that the maximum prices to consumers shall be 30s. per ton for furnace coke, and 40s. for foundry coke, on truck at the ovens. The present market quotations for these qualities for export range 5s. higher than the maximum fixed for home consumption. The deputation stated they were given to understand that the Munitions Board had already taken action for fixing maximum prices for pig iron, and also contemplated fixing maximum prices for the finished product.



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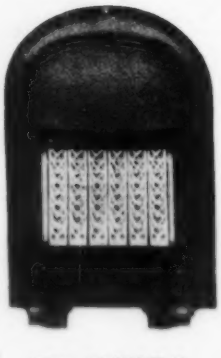

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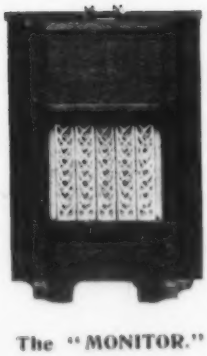

The "MONITOR."

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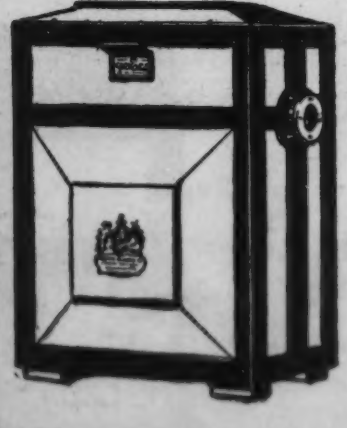

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aptly describes George Glover's Dry Gas Meter. Giving "correct" registration at all outputs and at varying pressures, it will be found satisfactory under the most trying conditions. Every meter leaving their works, irrespective of size—and they build up to 3000 lights—is regulated and tested for soundness at 12-in. pressure, and for registration not only at the ½-in. pressure prescribed by the "Sales of Gas Act," but at 3-in. pressure with full outlet capacity so as to prevent slow registration even when the Meter is overworked. Since 1861 the
George Glover Dry Meter
has gained the highest awards at the principal International Exhibitions and to-day represents the ideal gas recorder.
PARTICULARS AND PRICES ON APPLICATION.
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RANELAGH WORKS, CHELSEA, LONDON, S.W.

RITCHIE C.I. PIPES FOR GAS & WATER. MIDDLESBROUGH.

and made oval or trumpet-shaped in order to give a greater width of spread to the discharge of warmed air.

The air-heating apparatus and air flues are perfectly safe, and were passed by the Fire Insurance authorities—a point of importance, of course. They can also be easily masked or hidden, in order that they shall not be noticeable or unsightly, and they are not obtrusively large. At the New College Chapel one of the heaters is placed on the left of the organist, and can quite conveniently be enclosed. The other one is entirely out of sight—being at the rear of the organ.

Moderate Running and Installation Costs.

Naturally the first doubt that will arise is concerning the cost. This has proved to be quite moderate, as the quantity of gas consumed hourly is very small. The chapel authorities were recommended to leave the gas constantly burning in the heaters from early October to the end of April—a period of seven months. It was estimated that at the pre-war price of gas the cost would amount to about £7 for the whole winter season; but notwithstanding that the price was subsequently raised, it was found that the whole cost came to a trifle under £5—the gas being 2s. 8d. per 1000 cubic feet. There are two other points. Besides the current cost, What was the expense of the heaters and the installation? This, we are informed, in the case mentioned amounted to less than £10.

A Great Improvement.

Then, What has been the effect on the organ itself? This is really the crucial point; and it is therefore satisfactory to hear that the organist and all concerned bear testimony to the great improvement of the organ since the apparatus was installed; while there is no trace whatever of corrosion in the action. Here and there there is some dryness, which may necessitate a little lubrication before the wet season sets in; but in these experiments this really was the result desired, as in the past the difficulty has been the effect of moisture. In this respect, it may be pointed out that excessive dryness is almost as bad an enemy as excessive moisture; but with so low an expenditure of gas, this is not very likely to arise; and, in any case, no doubt the attention of gas engineers can be directed towards obviating it. A point worth mentioning is that the constant heat generated is of some, though possibly slight, value towards the general warming of the building, apart from its special application in connection with the organ. We understand the apparatus has been provisionally protected.

Summary.

To sum up, the cause of organ troubles is primarily the extreme variations of temperature, due not only to often-marked changes in the natural atmosphere, but to the irregularity of heating methods. It is no unusual thing for a church to be heated on Sunday to 60° or more, which in the middle of the week falls nearly to freezing point. In our youth we often practised in woollen gloves, in order to retain consciousness of our fingers, whereas on a Sunday it was necessary to remove one's overcoat. If the deleterious effect of these variations can be prevented by the installation of an apparatus which is both cheap to set up and inexpensive to maintain, it is surely worth the notice of church authorities and organ-builders. Too often a costly instrument is erected, and left to its good behaviour, so to speak, with very inadequate attention beyond regular tuning, perhaps once a quarter, perhaps oftener. We feel sure that any device which ensures a steady temperature would add to the life and efficiency of the instrument, and would in the long run justify its cost.

It may be added that the apparatus for keeping the organ dry is being made by the Davis Gas-Stove Company, Limited.

JARROW RAILWAY ACCIDENT.

Gas Lighting in Trains.

The terrible railway accident which occurred last Friday week near Jarrow, when at least seventeen persons lost their lives as the result of a collision (the remains in sixteen cases being so charred that identification was a difficult task), has led to renewed discussion in some of the newspapers of the subject of gas lighting for trains; and this aspect of the matter was also referred to in the course of the evidence given during the Board of Trade inquiry by Colonel Von Donop, at Newcastle-on-Tyne.

Alexander Mitchell, the guard of the passenger train mainly involved, said that after the collision he left his train to summon help, and on returning found the leading vehicle of it was on fire. He did not know whether any other portion of the train was on fire at the time. He thought that gas was escaping. The five rear vehicles were uncoupled and drawn away. Another guard, named Robert Taylor, said he thought it came from the roof lamps of the carriage, as the roof was alight and not the lower part. At the time he did not see anyone attempting to extinguish the fire. The rear vehicles were uncoupled; but he could not exactly say why he did not take steps to uncouple the third vehicle, which was not alight. He saw no passengers in the leading or the second vehicle. There were no lights on his train. They were all put out at Hebburn.

Sampson Talliday, an engine driver, who was a passenger in the train, stated that he was in the second compartment of the second vehicle. After he had managed to get out of it, he set to work to liberate the passengers from the compartment in front of his. Two passengers who were alive, and one who was dead, were left in the compartment. While he was working, he noticed a small jet of fire rising from the top of a gas-cylinder under the carriage in which the people were imprisoned. He at once sent three men to fetch the fire extinguishers which he knew would be on the train. Witness left

The Year 1915—

introduced a new principle in Gas Fire construction; Richmond's "R.H.D."—the first to efficiently distribute Radiant Heat.

The Richmond Gas Stove & Meter Co, Ltd.
Warrington & London.

the passengers and went under the carriage to try to put out the fire, but without success. Finding that he could not extinguish the flames under the carriage, he went round to the other side of the compartment, where he knew the passengers were fast. He tried to extinguish the fire there, but failed to do so; and by that time the flames were spreading rapidly to the top of the carriage, and the people inside began to shout. He was unable to say what caused the jet of flame under the carriage; but he did not think it was due to the ashes from the engine. Witness went on to the top of the carriage, and played on the fire with an extinguisher; but it had no effect.

Mr. A. C. Stamer, Acting Chief Mechanical Engineer of the North-Eastern Railway Company for the construction of rolling stock, gave evidence regarding the lighting arrangements of the two vehicles. The gas was carried in three cylinders in the case of the leading vehicle, and by four cylinders in the second vehicle, which was partially burned. The vehicle of the other train which was burned also had three gas-cylinders. The cylinders were placed underneath the vehicles, and well up into the frame. One of the cylinders was found knocked off the coach, and lying at the rear of the engine. It was the cylinder at the leading end of the first vehicle. On examination it was found to be burst at both ends. The back of the bunker of the engine was badly scorched. He thought it was due to the proximity of the burning coach, and not necessarily to gas from the cylinder. Owing to the cylinders being burst, he considered the gas quickly escaped. Witness further stated that the other two cylinders were found in position on the coach. One was delved in at the bottom; but he did not think it was split. The other was burst away at both ends. The pipe connections were broken away from all the cylinders. In regard to the cylinders of the second vehicle, all were in order, and in position; and only one connection was broken. This was the leading right-hand cylinder of the four. All the low-pressure pipes, however, were severed and burst. Two of the cylinders of the leading vehicle of the down train were in good order, and in their proper positions on the train. The other one was in position; but it was burst at one end. The cylinders were not fitted with safety valves. His Company had made one or two trials with different sorts of automatic valves, having for their object to prevent the rush of gas out of the cylinders if any of the pipe-connections were severed. The result of the experiments with these valves was, however, unsatisfactory. They were found to be unreliable, and not to shut-off as they were supposed to do. The Company were still making experiments.

The INSPECTOR: Have your Company taken any special steps within the last few years to take precautions against fire on trains?

Witness: Yes, we have gone into the question.

Will you kindly tell me what steps you have taken?—We have fitted 770 vans with rescue appliances and fire appliances. That is out of a total of 836 vans which we propose to fit up. We have also fitted 924 with a lead pipe on the low-pressure side of the gas-regulator—that is the pipe which runs up the outside of the end of the vehicle to feed the lamps.

What was the object of that?—The object is that if there is a rupture of the pipe it can be readily closed by means of a hammer. This could not be done in the case of the old steel pipes.

Proceeding, witness said that since the Company introduced incandescent gas they had found that they could reduce the number of cylinders under each vehicle, and, in order to obtain twenty-four hours' lighting, they found that they could reduce the number of cylinders in most of the vehicles to one—thus doing away sometimes with two, and sometimes three cylinders. They had altered 334 vehicles in this respect. Having regard to the condition of the cylinders after the accident, his own opinion was that it would be a very short time before all the gas was out of the cylinders. In fact, in the first coach which was burnt out, there was only one cylinder which was not ripped open, and from which the gas would have to escape by means of the connection on the cylinder.

William Dunlop, a guard, said the fire originated in the front part of the carriage, and the flames seemed to rise up from the bottom through the wreckage.

The inquiry is to be re-opened when the engine-drivers of the trains are ready to give evidence.

The inquest was opened at South Shields on Monday last week; and after evidence of identification had been given, the proceedings were adjourned until Jan. 18.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Dec.* 24.

In view of the holidays, the tar products market has been extremely quiet, and without alteration in prices.

Sulphate of ammonia is very strong; and £17 5s. net per ton in buyer's bags, *ex* maker's works, has been paid for 25 per cent. quality.

Tar Products in the Provinces.

Dec. 24.

There is nothing fresh to report concerning the market for tar products. Pitch is still in the same unsatisfactory position, and, owing to the shortage of tonnage, contracts cannot be arranged. Creosote is quiet, with little or no business doing. Solvent and heavy naphthas are in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 18s. 6d. to 22s. 6d. Pitch, East Coast, 15s. 6d. to 16s. 6d. per ton; West Coast, 15s. to 15s. 6d. Manchester; 16s. to 16s. 6d. Liverpool; 17s. to 18s. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 2s. to

Careful attention will be given to YOUR enquiries.

R. & J. DEMPSTER, Ltd., MANCHESTER.

London Office:
165, GRESHAM HOUSE,
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2s. 2d. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2⅜d. to 2⅝d. Heavy oils, in bulk, 3⅜d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 6d. naked. Naphthalene, £18 to £28; salts, 75s. to 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Dec.* 24.

Throughout the week the market for this article has continued on its upward course without any check, and a fresh record has been established in high prices since the year 1883. The nearest values at the close are £17 5s. per ton f.o.b. Hull, £17 12s. 6d. f.o.b. Liverpool, and £17 17s. 6d. f.o b. Leith. There has been good inquiry in the forward position, and it is reported that business has been done at the principal ports at £17 17s. 6d. per ton for January-March delivery, £17 10s. April-June, and £17 5s. July-December.

Nitrate of Soda.

This market has become quieter, but values are fairly well maintained at 15s. 3d. per cwt. for ordinary, and 16s. 3d. for refined quality, on spot.

Sulphate of Ammonia.

From another source, it is stated that the market for this article still continues upward; and it is reported that very high prices are being paid for delivery over the whole of next year. Outside London, makes are quoted at £16 5s. to £16 7s. 6d.; Hull, £17 2s. 6d. to £17 5s.; Leith, £17 5s. to £17 7s. 6d.; Middlesbrough, £17 2s. 6d.

COAL TRADE REPORT.

Northern Coal Trade.

The northern coal trade is active, but the demand for Admiralty purposes is heavy, and there is little fuel free for sale for a fortnight or so. In the steam coal trade, the output is well taken up, and forward business is not very easily entered into at present. Best Northumbrian steam coals are nominally about 22s. per ton, with little for prompt sale. Second-class steams are 20s.; and steam smalls are higher at 11s. to 13s. 6d. per ton, according to quality—all f.o.b. In the gas coal trade, the shipments have been full; but the holidays intervened, and the production will be only limited till after the turn of the year. Quotations are a little varied. For best Durhams, about 21s. to 21s. 6d. per ton f.o.b. may be put as the current price; second-class gas coals are near 19s. to 19s. 6d. per ton; and "Wear Specials" are firm at 21s. to 22s. 6d. per ton f.o.b. The smallness of the prompt supply, and the fact that on the long contracts the deliveries should now be at the heaviest, make these prices largely nominal, and probably little new business is being done for early delivery. Forward contracts are often in negotiation at the turn of the year; but there is not much heard of any, and the high freight has its effect. For gas coal, Tyne to London, the freight is about 15s. at present, though much coal is being carried on long contracts at considerably lower rates. Coke is firm, and rather scarce. The production of gas coke is heavy; and the price is about 28s. to 30s. per ton f.o.b. in the Tyne. But the high freights keep down the exports of coke also.

Sale of Shares.—At a local auction sale recently 500 shares of £1 each in the Woodbridge District Water Company were disposed of at prices ranging from 13s. 6d. to 14s. 3d. per share. The rate of interest paid on the shares last year was 3½ per cent.

Lighting of Athens.—The "Times" correspondent in Athens states that the shortage of coal for lighting purposes has caused measures of severe economy to be taken; and the Government have ordered a reduction in the lighting of the city by one-half. The announcement on Christmas Eve of the arrival of 6000 tons of Newcastle coal was received with satisfaction.

European Gas Company, Limited.—The Secretary of the Company (Mr. W. B. Brady) intimates that the Directors have decided to pay on Feb. 1 the same interim dividend as last year—10s. per share, free of income-tax. Until the accounts are made up for the financial year, it is impossible for the Directors to estimate how far the profits of the Company will be affected by the war, and what the amount of the final dividend will be.

Lighting Matters at Hendon.—The Hendon Rural District Council are continuing negotiations with the Harrow Gas Company, with a view to obtaining a reduction in the annual charge for street lighting. It was stated at the last Council meeting that the Company were now receiving for maintenance 2s. per month per lamp on the 224 lamps in the parish of Pinner. Upon this being pointed out to the Company, a letter had been received stating that as practically the whole of the lamps were unlighted in the district they could not reduce the charge. The Surveyor remarked that, under the present arrangement, the Council were paying £268 a year for nothing at all.

Maximum Coke Prices.—At a meeting at Cardiff last Wednesday of the South Wales Coke Manufacturers' Association, it was reported that a deputation had had an interview at the Ministry of Munitions in respect of a proposal to fix maximum prices for coke with a view particularly to ultimately bringing down the price of steel. The deputation stated they had agreed with the Munitions Department that the maximum prices to consumers shall be 30s. per ton for furnace coke, and 40s. for foundry coke, on truck at the ovens. The present market quotations for these qualities for export range 5s. higher than the maximum fixed for home consumption. The deputation stated they were given to understand that the Munitions Board had already taken action for fixing maximum prices for pig iron, and also contemplated fixing maximum prices for the finished product.

The "LOUVAIN."

The "LILLE."

MANUFACTURERS:

The VULCAN STOVE CO., Ld.

EXETER.

Telegrams: "VULCAN, EXETER."

The "MONITOR."

Sedgley Gas-Works Results.

The report of the Sedgley Urban District Council Gas Committee, for the year ended March 31 last, states that the revenue from all sources amounted to £8315; and after meeting expenses, including loan repayment, a net profit remained of £1530. Of this, £750 was in March last transferred to the district fund account, and the balance added to the revenue trading account. The Committee call attention to the fact that this is the first complete year of working of the new carbonizing plant; and, as anticipated by the Sub-Committee upon the presentation of their scheme, a substantial saving in labour has been effected—the payment under this head being £405, against £611 for the preceding year, with a heavier amount of coal carbonized. During the year, an expert was called in upon the question of distribution; and, acting upon his advice, it was decided to lay enlarged mains, at an estimated cost of £2650, added to which was the sum of £100 for a new station governor, and £250 for alterations to mains at the works, and contingencies. For this sum of £3000 application was made to the Local Government Board; but, owing to the war, sanction to borrow was refused. In view, however, of the urgent necessity of ensuring a more adequate supply to the consumers furthermost from the works, it was decided to proceed with the first portion of the scheme, defraying the cost out of the reserve fund.

Accident at a Birmingham Gas-Works.—Last week, a double fatality occurred at the Windsor Street works of the Birmingham Corporation Gas Department; two men falling down a lift shaft a distance of about 30 feet on to a concrete floor. Assistance was quickly forthcoming; and they were removed with all promptitude to the General Hospital. One man, however, died before the institution was reached, and the other shortly afterwards. How the accident happened is not clear, as the men were alone in the house where they had been engaged. The lift is an electric one; and there are iron gates on each floor which work automatically. It is presumed that the men were leaning against the gate when it suddenly opened.

Wages at Rochdale.—The Rochdale Town Council were recommended by the responsible Committee to grant to their gas workers a permanent increase of wages, in lieu of a war bonus. Applications had been received from the men for a reduction of hours, a permanent increase of wages, and a week's holiday each year with pay. These demands had been carefully considered by the Works Sub-Committee, who reported to the General Committee. It was then decided that no reduction of hours could be made. As to holidays with pay, this question was settled by the Council some time ago. In the matter of wages, the Committee recommend the Council to grant permanent increases (in place of the war bonus) to 143 men. These advances represent £780 a year; and if the amount of the present bonus is deducted, the net increased cost to the department will be somewhere about £200.

Public Lighting at Southend.

The Highways Committee of the Southend-on-Sea Town Council have again had under consideration the accounts of the Gas Company for street lighting for the Michaelmas quarter. The Secretary of the Company attended before the Committee to deal with the charges made during the continuance of the reduced lighting. The Committee were reminded that the original principle adopted was that a deduction should be made from the ordinary quarterly account equal to the actual value of the gas unconsumed; so that when all the gas-lamps were extinguished, only the standing charges incidental to their installation and maintenance would be charged. The Committee were also reminded that the Company had made a further allowance at the rate of 2s. per lamp per annum, in view of the saving effected in mantles during the total discontinuance of the lighting. After the matter had been discussed, the Company agreed to make a further allowance of 1s. 6d. per lamp per annum from the amount of the standing charges, thus effecting another reduction in the account of about £112 per annum. With reference to the lighting of the Leigh area of the town, the Surveyor reported at a later meeting that the Gas Committee were prepared to reduce their charges to the same extent as had been arranged in regard to the accounts of the Southend Gas Company. In view, however, of the higher cost of gas in the Leigh area, the Surveyor was directed to bring the matter again before the Gas Committee for consideration.

Price of Gas at Brisbane.—A Bill to deal with the price and quality of gas at Brisbane is to be introduced at an early date. The measure will, it is said, be far-reaching, and will have the effect of largely reducing the price of gas.

Increase in Price at Bingley.—On the recommendation of the Gas Committee it was last week decided by the Bingley Urban District Council that the price of gas should be increased 6d. per 1000 cubic feet. In answer to a question, the Chairman (Mr. H. Laycock) stated that the increase was no greater than was required to meet the extra cost of coal and labour, and it was really very doubtful whether it would altogether cover the higher cost.

Budleigh Salterton Public Lighting.—At a meeting last Tuesday of the Budleigh Salterton Urban District Council, the Public Lighting Sub-Committee reported having met representatives of the Gas Company, when the questions at issue between the Council and the Company were fully discussed. The Sub-Committee intimated that the Council were not prepared to increase the offer made by them to pay 10s. per lamp for the year to March 31 last. Dr. Perkins, on behalf of the Gas Company, stated that they could not accept such an offer, but intimated that if it was increased to £1 1s. per lamp it would be accepted. In this deadlock the Clerk was instructed to prepare a case for Counsel, but later the parties compromised with 12s. 6d. per lamp; and a resolution was passed accordingly.

Write for Particulars and Samples.

THE WELSBACH LIGHT COMPANY, LTD.,
WELSBACH HOUSE, KING'S CROSS, LONDON, W.C.
AND AT BIRMINGHAM, MANCHESTER, LEEDS, STOKE-ON-TRENT, HULL, BRISTOL, AND DUBLIN.

Welsbach Mantles are Upright (C, CX, and Plaissetty) and Inverted.

The Filey Council have decided not to appoint a gas engineer for the present in succession to Mr. Henry Tobey, the Manager of the Malton Gas-Works, who recently resigned his position as Supervising Engineer at Filey. The Council are to call in advice as necessary.

Acknowledgment has to be made of the receipt of a serviceable pocket case and diary from the Gas-Meter Company, Limited, Kingsland Road; and a case for Treasury notes from Messrs. Pinchbeck, Limited. There has also come to hand the Co-Partnership Almanac of the South Metropolitan Gas Company, which on this occasion includes a Roll of Honour, in addition to a portrait of the late Sir George Livesey, with the words beneath it "Co-partnership is Brotherhood in Business," as well as the following Directors' message: "Another twelve months of war have passed and left unweakened the bonds of a co-partnership which has long flourished among the employees of this Company. All are sharing cheerfully the burden of increased strain and anxiety thrown upon them by the response of so many of their companions to the country's call. They are maintaining magnificently the war fund, voluntarily created by their contributions, to provide for the families and dependants left behind. In bearing this testimony to the crowning glory of co-partnership, the Directors earnestly hope victory may justify relaxation of these efforts in the New Year."

APPLICATIONS FOR LETTERS PATENT.

17,415.—Bell, R., "Art of gas lighting and burners therefor." Dec. 13.

17,493.—Williamson Cliff, Ltd., and Cliff, A., "Manufacture of refractory articles." Dec. 14.

17,543.—Harvey, E. W., "Regenerative gas-furnaces" Dec. 15.

17,563.—Lanston Monotype Corporation, Ltd., "Burners for melting-pots." A communication from the Lanston Monotype Machine Company. Dec. 15.

17,620.—Humphrey, H. A, and Rusdell, W. J., "Inlet and exhaust in internal combustion engines." Dec. 16.

17,621.—Humphrey, H. A., and Rusdell, W. J., "Pump for liquids." Dec. 16.

17,622.—Humphrey, H. A, and Rusdell, W. J., "Valves for pumps for liquids." Dec. 16.

17,628.—Chaney, W., and Boughton, H. F., "Gas manufacture." Dec. 17.

17,670.—Ionides, A. C., jun., "Proportioning gaseous mixtures." Dec. 17.

STOCK MARKET REPORT.

The paucity of business on the Stock Exchange was illustrated last week by the closing of the House after the termination of Thursday's operations until after the Christmas holiday. This, perhaps, was in some measure a result of the upset caused in the preceding week by the invasion of the French Loan and the Exchequer Bond issue. So the markets had a quiet four-day period, and one that was not without its good points. A favourable feature was the firmness of Home Government issues and other constituents of the gilt-edged division. The War Loan and Consols steadily acquired strength, and Colonial issues were in demand. The American Market was firmer; and Canadian Pacific reflected the bright prospect afforded by a splendid harvest and big traffic returns. South Africans consolidated their good position. In the Foreign Market, the French Loan and Japanese issues continued to find favour. In the Miscellaneous Group, Rubber improved its outlook, and armaments and other warlike appliances were in request. Home Rails did not succeed in keeping step with the rest; but they made a little better show before the close. So that, taken all round, prices advanced, and the week terminated cheerfully. As regards the internal affairs of the House, one or two matters were much in evidence. Great soreness has been felt by members that some restrictions imposed upon them—*e.g.*, as to minimum prices—should be allowed to be bye-passed by outsiders. It is hoped that action taken by the Committee will remove this disadvantage. In regard to the exclusion of members of Teutonic birth, the resolution passed by the Committee is thought by many not to go far enough. Widespread irritation is felt at the Stock Exchange being ignored by the Treasury and not consulted in relation to various points of national finance, in which they could afford expert advice. Another source of friction—as to commission upon the American securities acquired by the Treasury through the agency of members—is being dealt with. Business in the Gas Market was quite quiet and devoid of feature. Prices may be quoted generally as unchanged. In the Money Market, the supply met all demands for short loans with ease, but discount rates hardened.

Bargains done for cash during the week were as follows: On Monday, European 12½, Gas Light ordinary 72, 72½, Primitiva preference 3 5/16, 3⅜, 3 7/32, 3 11/16, South Metropolitan 79½. On Tuesday, Commercial 4 per cent. 81, European 12 11/16, Gas Light ordinary 72, 72⅜ 72½, Primitiva preference 3 5/16, River Plate 72, South Metropolitan 79. On Wednesday, European 12 11/16, Gas Light ordinary 71⅞, 72, Melbourne 96⅞, South Metropolitan 79½, Wandsworth "B" 100. On Thursday, Commercial 4 per cent. 78, European 12 11/16, Gas Light ordinary, 71, 71⅛, 71½, South Metropolitan 78½.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

Lance-Corporal Richard Rossall, of whom his parents at Pudsey have recently learned that he has been awarded the Distinguished Conduct Medal, was, prior to enlisting for the war, a stoker at the Pudsey Corporation Gas-Works. He received the award, and also his promotion, for bravery in action at Hooge.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5½	Alliance & Dublin Ord.	59—64	8 18 2	..
374,000	,,	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	3/-	Bombay, Ltd.	5⅞—6⅜	5 17 8	..
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water: 10 p.c.	29—30	5 6 8	..
878,480	10	,,	7	7/-	Bournemouth Gas and Water: B 7 p.c.	15—15½	4 10 4	..
95,000	10	,,	6	6/-	Bournemouth Gas and Water: Pref. 6 p.c.	13½—14	4 5 9	..
147,240	—	—	—	4	Bournemouth Gas and Water: Deb.	..	—	..
980,000	Stk.	Feb. 26	†14	56/-	Brentford Consolidated	261—266	5 5 3	..
830,000	,,	,,	†11	55/-	Do. New	204—209	5 5 8	..
50,000	,,	,,	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
206,250	,,	June 11	4	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
217,880	Stk.	Feb. 26	11	10½	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	,,	,,	8	7½	Do. A Ord. Stk.	154—159	5 0 8	..
630,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	73—81
560,000	,,	,,	5½	46/8	Do. 3½ p.c. do.	103—105	5 1 6	..
475,000	,,	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 8 11	..
800 000	Stk.	,,	4	4	Continental Union, Ltd.	76—79	5 1 8	..
200 000	,,	,,	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk	—	6	6	Derby Con. Stk.	123—125	4 16 0	..
55,000	,,	—	4	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd.	17½—18	5 11 1	12½—12 11/16
16,362,910	Stk	Feb. 12	1/17/4	42/-	Gas Light and Coke: 4 p.c. Ord.	98—102	4 15 6	71—72½
2,600,000	,,	,,	3½	3½	Gas Light and Coke: 3½ p.c. max.	76—79	4 8 7	..
4,062,235	,,	,,	4	4	Gas Light and Coke: 4 p.c. Con. Pref.	96—99	4 0 10	..
4,674,850	,,	June 11	3	3	Gas Light and Coke: 3 p.c. Con. Deb.	72½—74½	4 0 6	..
130,000	,,	,,	10	10	Gas Light and Coke: 10 p.c. Bonds	..	—	..
258,740	Stk	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16¾	6 11 4	..
86,603	—	—	—	9½	Hornsey 7 p.c.	..	—	..
181,000	Stk.	Mar. 12	7⅞	7⅜	Ilford A and C	151—154	5 2 4	..
65,780	,,	,,	6⅝	6½	Do. B	115—118	5 8 0	..
65,500	,,	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk	May 14	9	4½	Imperial Continental	150—160	5 12 6	..
1,235,000	Stk.	Feb. 12	3½	3⅜	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
561,000	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	..
718,100	,,	,,	7		Liverpool 5 p.c. Ord. B	146—148	4 14 7	..
306,083	,,	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4½—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	96¾
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 13 4	..
1,775,892	Stk.	July 29	4½	4½	Newc'tle&G'tesh'd Con.	98½—99¼	4 10 6	..
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
65,940	10	Feb. 26	7/14/0	7/8⅝	North Middlesex 7 p.c.	14—15	5 2 8	..
800,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7¾	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B	128—131	4 19 3	..
100,000	50	,,	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	,,	10	—	Do. D	..	—	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	6 18 4	..
499,960	5	June 26	6	2/6	,, 5 p.c. Pref.	4⅞—5	5 0 0	3 5/16—3 11/16
521,600	100	June 2	4	4	,, 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	4	,, ,, ,, 1911	..	—	..
846,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	86—87	4 12 0	74
150,000	10	May 14	6	6/-	San Paulo: 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	San Paulo: 5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	238—234	4 9 3	..
209,984	,,	,,	10	10	Do. B	232—234	4 9 3	..
528,500	,,	,,	10	10	Do. C	230—232	4 10 1	..
90,000	10	May 28	9	6/-	South African	10½—11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/4.0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	78½—79½
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	..
209,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 8 5	..
60,000	,,	,,	5	5	Do. 5 p.c. Pref.	110—112	4 9 8	..
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
187,058	,,	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham and District: A 5 p.c.	135—138	5 8 8	..
742,275	,,	,,	6	6	Tottenham and District: B 3½ p.c.	115—117	5 2 7	..
181,255	,,	June 26	4	4	Tottenham and District: 4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
90,000	Stk.	Feb. 26	8¾	78/9	Wandsworth, Wimbledon, and Epsom—Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	,,	,,	6¾	63/9	,, B 3½ p.c.	129—134	5 2 7	100
108,075	,,	,,	5/17/3	55/11½	,, C 3½ p.c.	110—115	5 2 0	..
852,000	,,	,,	6¾	57/6	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	,,	,,	6¾	63/9	Epsom 5 p.c.	121—126	5 5 2	..
88,416	,,	June 26	3	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

The Stockton-on-Tees Chemical Works has been registered with a capital of £10,000 in £1 shares. The address of the Company is Parkfield Works, Stockton-on-Tees. The registration is as a "private" company. The first Directors are Mr. E. Lloyd Pease and Mr. W. Beswick (representing the Power Gas Corporation), and Mr. A. F. Pease (representing Messrs. Pease and Partners).

The "Mechanical World" Electrical Pocket-Book for 1916 (which is published by Messrs. Emmott and Co., Limited, of No. 65, King Street, Manchester, at the price of 6d. net) contains, as usual, a large amount of useful information on a variety of subjects connected with the electrical industry. Among the new features, a prominent place is taken by the lengthy section on switch gears and switch boards. The sections on electric lamps and electric lighting have been brought up to date, and the book generally has been thoroughly revised.

The covers of three electric light street-boxes were blown off by explosions in Rotherhithe Street last week; the occurrence being attributed to defective electric circuits. One of the firemen attending received a shock, and was taken to the hospital, but not detained.

At the last meeting of the Bradford Gas Committee, when the question of advancing the price of gas from 2s. 6d. to 2s. 9d. per 1000 cubic feet was deferred until May, it was mentioned that there were private companies with a smaller production who charged less for gas than the Bradford present charge.

Tenders are invited (on conditions which will be found notified in our advertisement columns to-day) for £20,000 of "D" ordinary 7 per cent. stock in the Colne Valley Water Company. The minimum price fixed is £125 per cent., at which, it is pointed out, the yield to the investor will be £5 12s. per cent. per annum.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

SUPERINTENDENT. Portsea Island Gas Company. Applications by Jan. 1.
MANAGER. Louth Gas Company. Applications by Jan. 5.
DRAUGHTSMAN. Bale and Hardy, 39, Victoria Street, S.W.
MECHANICS. No 6128.
SALESMAN. Rochdale Gas Department. Applications by Jan. 5.
WORKING FOREMAN. Holbeach Gas Company.

Appointments, &c., Wanted.

SHOW-ROOM MANAGER. A. C. Portbury, Rochdale.

Plant, &c. (Second Hand), Wanted.

PURIFIERS. No. 6129.

Sales of Stocks and Shares.

COLNE VALLEY WATER COMPANY. By tender. Jan. 11.
HAYWARDS HEATH GAS COMPANY. By tender. Jan. 14.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year 1916 are reminded that this can only be done before the end of January.

Orders to Alter or stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Saturday.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

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Payable in advance. If credit is taken, an extra charge of 4s. a year is made.

Abroad (in the Postal Union): £1 7s. 6d., payable in advance.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

Telegrams: "GASKING, FLEET LONDON." Telephone: Holborn 6857.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 171, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

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DRY METERS

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D. ANDERSON AND COMPANY,
GAS LIGHTING ENGINEERS AND CONTRACTORS.
18 & 20, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "DACOLIGHT LONDON." Telephone: 2336 HOLBORN.

MEWBURN, ELLIS, AND PRYOR.
CHARTERED PATENT AGENTS AND TRADE MARK AGENTS,
70, Chancery Lane, London.
Telegrams: "Patent London." 'Phone: 243 Holborn.
And 3, St. Nicholas Buildings, Newcastle-on-Tyne.

ALDER AND MACKAY
ESTABLISHED 1850).
WET AND DRY METERS.
SLOT AND ORDINARY.
STREET LAMPS AND AUTOMATIC CONTROLLERS.
EDINBURGH.

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the best. Satisfaction Guaranteed.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, London, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 815 Oldham, and 2412 Hop, London.
Telegrams—
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SEND your inquiries for Carburetted HYDROGEN AND BLUE WATER-GAS PLANT, also TAR DEHYDRATING PLANT and other GAS-WORKS APPARATUS to—

BALE AND HARDY,
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SPECIALLY prepared for the manufacture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL, LTD.,
with which is amalgamated WM. PEARCE & SONS, LTD.,
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Telegrams: "HYDROCHLORIC, FEN. LONDON."
Telephone: 1588 AVENUE (3 lines).

SPENCER'S PATENT HURDLE GRIDS.

THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, Nov. 16, p. 354.

FOR

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TRY

JAMES MILNE AND SON, LIMITED.

ENQUIRIES SOLICITED.

FOR Gas-Works Plant of Every Description; also SULPHATE OF AMMONIA and SULPHUR RECOVERY PLANTS,
C. & W. WALKER, LIMITED,
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JOSEPH A. HUTCHISON, LIMITED,
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We are in a position to Supply Oxide of Iron promptly, and invite Enquiries.
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BALE & CHURCH, LTD.
5, CROOKED LANE, LONDON, E.C.

"TORTO" FIRE CEMENT.
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Tins for sale to Consumers.
In Bulk for Works Use.
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5, CROOKED LANE, LONDON, E.C.

FOR

ALL METERS

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HUTCHINSON BROTHERS, Ltd.,
FALCON WORKS, BARNSLEY.
MANUFACTURERS OF
GAS METERS (Ordinary and Prepayment),
"FALCON" INVERTED LAMPS and SQUARE LANTERNS for Street Lighting,
INVERTED BURNERS and CONVERSION SETS for Street Lamps.

RICHARDSON'S
"PLUTONIC" FIRE CEMENT.
(Powder or Paste).
For Gas Retort and Furnace Repairs, &c.
(42nd Year of Sale).
Prices and Samples free on Application.
THE "PLUTONIC" CEMENT COMPANY,
Telegrams: "PLUTONIC, BIRMINGHAM." 62, BISSELL STREET, BIRMINGHAM.

SULPHATE OF AMMONIA SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We Guarantee promptness with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
Telegrams: "SATURATORS BOLTON." Telephone 2642.

ROBERT DEMPSTER & SONS, Ltd., Contractors for Complete CARBONIZING PLANTS and every Description of GAS APPARATUS, ELEVATING, CONVEYING, and TELPHERAGE PLANTS, also STOKING MACHINERY, Rose Mount Ironworks, Elland.

"GAZINE" (Registered in England and Abroad). A radical Solvent and Preventative of Naphthalene Deposits, and for the Automatic Cleaning of Mains and Services.
It is also used for the Enrichment of Gas.
Manufactured and Supplied by C. Bourne, West Moor Chemical Works, Killingworth, or through his Agents, F. J. Nicol & Co., Pilgrim House, Newcastle-on-Tyne.
Telegrams: "Doric," Newcastle-on-Tyne. National Telephone No. 2497.

TAR WANTED.

THE Burnden Tar Company (Bolton), Ld. Hulton Chemical Works, BOLTON.

J. E. C. LORD, Ship Canal Tar-Works, Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

EDWARD COCKEY & SONS, LTD.,
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COMPLETE CARBONIZING PLANTS,
WASHER SCRUBBERS,
PURIFIERS,
SPIRAL OR STANDARD GUIDED GAS-HOLDERS.
Prices and Designs on Application to
THE IRONWORKS, FROME, or
London Office: 39, Victoria St., Westminster S.W

JOHN RILEY & SONS, Limited, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 years. References given to Gas Companies.

GAS Show-Rooms—Situation required as MANAGER. Well up in Cooking, Heating, Lighting, and Hot-Water Apparatus. Keen buyer. Good Organizer. Excellent Testimonials.
Address A. C. Portbury, Corporation Gas Show-Rooms, Rochdale.

WANTED—A Practical Manager for Company making 50,000,000 cubic feet. Applicants must be used to Regenerative Settings, Sulphate Plant, and Outside Management, and be Ineligible for Military Service. House, Coal, and Gas found.
Applications, in writing, stating Age, Experience, and Salary required, accompanied by not less than two Testimonials, to be sent by the 5th of January next to Mr. Philip Allison, Secretary, Gaslight Company, Louth, Lincs.
Louth, Dec. 18, 1915.

WANTED—at once, a Working FOREMAN (not eligible for Military Service) for small Gas-Works carbonizing about 700 Tons of Coal Yearly.
Applicants must state Age, Wages required (good House, Garden, Coals, and Gas found), and send in their References to Thos. C. Willders, Secretary, Gas Company, Holbeach.
Holbeach, Dec. 23, 1915.

EXPERIENCED Draughtsman Wanted in London. Thorough Knowledge of Bye-Product Coking Plant essential.
Apply, stating Age, Salary required, and all Particulars, to Bale and Hardy, 39, Victoria Street, London, S.W.

PORTSEA ISLAND GASLIGHT COMPANY.

FLATHOUSE WORKS.

APPLICATIONS are invited for the Position of SUPERINTENDENT for the above Works, where the daily make of Gas is from 3,000,000 to 4,000,000 cubic feet.
Candidates must have a Thorough Practical Knowledge of Carbonization in both Horizontal and Vertical Retorts, and have had a Good Technical Training, together with the Management of a large Works in all its Branches.
Commencing Salary, £250 per Annum, with House and Rates (only) free.
Applications, stating Age, previous Experience, whether Married or Single, accompanied by *copies* of not more than Three Testimonials of recent date, and endorsed "Superintendent," must be sent to me not later than the 1st of January, 1916.
J. D. Ashworth,
Engineer and General Manager.
Engineer and General Manager's Office,
Hilsea Gas-Works, Cosham, Hants.

WANTED—Two Good Mechanics for Suburban Gas-Works used to Gas and Steam Engines, Pumps, &c., and Lathes and Machines in Machine Shop. Wages according to Ability *plus* 5s. War Bonus.
Must be Ineligible for Military Service.
Apply, by letter, with Particulars of Experience, to No. 6128, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

BOROUGH OF ROCHDALE.
(Gas Department.)

THE Gas and Electricity Committee of the above Corporation invite Applications for the Position of SALESMAN in the Gas Department Show-Rooms in Drake Street.
Applicants must have had previous Experience in a similar capacity and be Ineligible for Military Service.
Salary, Two Guineas per Week.
Applications, in Candidates' own Hand-Writing and accompanied by not more than Three recent Testimonials, must be addressed to the Chairman of the Gas and Electricity Committee, Gas-Works, Rochdale, and Delivered before noon on Wednesday, Jan. 5, 1916.
By order,
Wm. Henry Hickson,
Town Clerk.
Town Hall, Rochdale,
Dec. 22, 1915.

WANTED—Good, Clean, and Hard CARBON, in Four-Ton Lots, or more, f.o.r.
Address, No. 6072, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED—One or Two Second-Hand PURIFIERS about 24 feet Square. Must be in Good Condition.
Particulars and Prices to No. 6129, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

TANKS for Sale—
One BOILER TANK, 6 ft. 6 in. diam. by 20 ft. long, £60.
One Dished-End AIR RECEIVER, 4 ft. 3 in. by 9 ft. 8 in., £25.
Two BOILER TANKS, 8 ft. 6 in. diam. by 20 ft. long, £75 each.
Two Oval BOILER TANKS, 8 ft. 6 in. deep by 6 ft. wide by 20 ft. long, £70 each.
One Egg-End BOILER TANK, 8 ft. diam. by 20 ft. long, £60.
One CAST-IRON TANK, in plates, 18 ft. by 12 ft. by 5 ft. deep, £75.
One CAST-IRON TANK, in plates, 14 ft. by 8 ft. by 4 ft. deep, £45.
One CAST-IRON TANK, in plates, 14 ft. by 7 ft. by 2 ft. deep, £30.
All Clean, Good Order, and Satisfactory in every way. Several other Sizes in Stock; also PUMPS, ENGINES, BLOWERS, EXHAUSTERS, GIRDERS, &c., &c. Inquiries Solicited, and prompt Attention Guaranteed.
Firth Blakeley, Sons, and Co., Ltd., Gas Plant Engineers, Church Fenton, Leeds.

ONE First-Class Lancashire Boiler 6 ft. 6 in. diam. by 15 ft. long. Insured for a Working Pressure of 120 lbs., with all Fittings Complete. Price £220.
Firth Blakeley, Sons, and Co., Ltd., Church Fenton, Leeds.

PATENTS.—Handbook of Patent Law, by W. P. Thompson, F.C.S., M.I.Mech.E., C.P.A., International Patent Agent, 6, Lord Street, Liverpool, and Bradford and London. 16th Edition 1915, 242 pages. 2s. 6d. Post free. English Portion, 6d. "A useful guide to inventors. The subject is treated in a simple and concise manner."—Journal of Gas Lighting.

THE GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given that the TRANSFER BOOKS of this Company, SO FAR AS THEY RELATE TO CAPITAL STOCKS, WILL BE CLOSED at Four o'clock p.m. on Tuesday, the 4th day of January next, and WILL BE RE-OPENED immediately after the Half-Yearly Ordinary General Meeting of the Company, to be held on Friday, the 4th day of February next.
By order,
Henry Rayner,
Secretary.
Chief Office: Horseferry Road,
Westminster, S.W., Dec. 22, 1915.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.
Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to Messrs. A. & W. Richards, at 37, Walbrook, E.C.

By order of the Directors of the
HAYWARDS HEATH DISTRICT GAS COMPANY.

MESSRS. A. & W. RICHARDS have RECEIVED INSTRUCTIONS TO OFFER FOR SALE BY TENDER
£3500 FIVE PER CENT. PERPETUAL DEBENTURE STOCK
at the Minimum price of Par, and
£5000 ORDINARY STOCK
also at the Minimum price of Par, in the above Undertaking.
The Ordinary Stock is entitled equally with the Company's existing similar Stock to a Dividend of £6 2s. 6d. per Cent. per Annum.
Tenders will be opened on Friday, Jan. 14, 1916.
Particulars and Forms of Tender may be obtained at the Company's Offices at Haywards Heath and 85, Gresham Street, E.C., and of Messrs. A. & W. Richards, Auctioneers, 37, Walbrook, E.C.

COLNE VALLEY WATER COMPANY.

NEW ISSUE OF £20 000 "D" ORDINARY 7 PER CENT. STOCK.
Minimum Price, £125 per £100 of Stock.
Yielding at this Price £5 12s. 0d. per Cent. per Annum.

TENDERS are invited for the above Stock, which ranks for dividend up to 7 per cent. equally with all classes of existing Ordinary Stock. Maximum Dividends have been paid by the Company for many years.
Tenders to be sent in on or before 10 a.m. on Tuesday, the 11th of January, 1916.
Forms and full Particulars to be obtained from the Secretary of the Company at their Head Offices, Bushey, Watford; from the London County and Westminster Bank, London and Watford; or of the Company's Brokers, Messrs. Sheppards, Pelly, Price, and Pott, 57, Old Broad Street, London, E.C.
By order of the Directors,
C. P. Sinclair,
Secretary and General Manager.

His Majesty's Treasury requires the following note to be appended:—
The Treasury has been consulted under the Notification of the 18th of January, 1915, and raises no objection to this issue. It must be distinctly understood that in considering whether they have or have not any objections to new issues the Treasury does not take any responsibility for the financial soundness of any schemes or for the correctness of any of the statements made or opinions expressed with regard to them.

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Shipments Promptly and Carefully Executed.
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Leadenhall Chambers, 4, St. Mary Axe, E.C.

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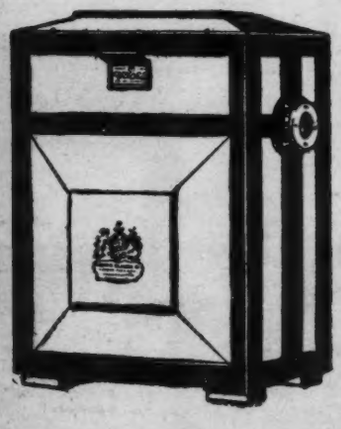

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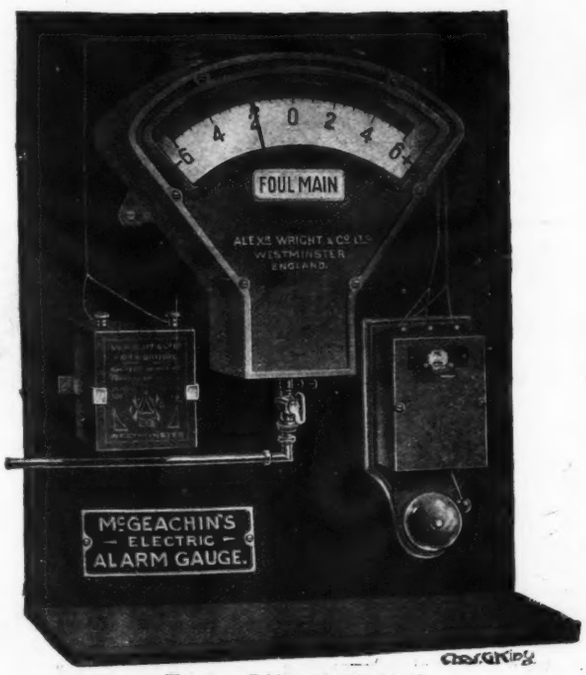

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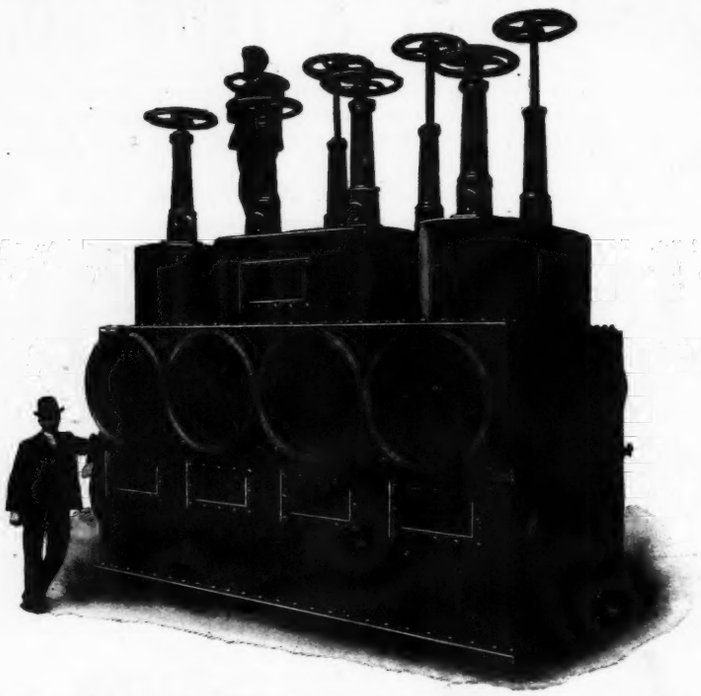

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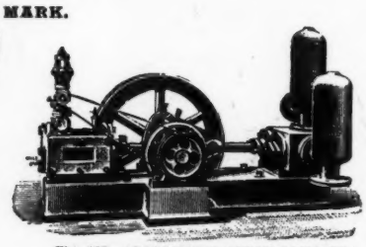

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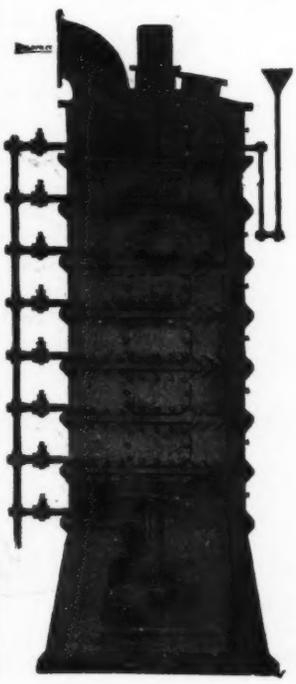

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Norwich (2)	300,000
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Poole (2)	1,000,000
Port Elizabeth	400,000
Portsmouth	1,000,000
Portsmouth (2)	2,000,000
Posen	450,000
Posen (2)	700,000
Prague	140,000
Preston	1,400,000
Reading	1,000,000
Reading (2)	1,000,000
Redditch	500,000
Redhill	275,000
Redhill (2)	300,000
Reichenberg	200,000
Reichenberg (2)	200,000
Reval	350,000
Rhymney	175,000
Rhymney (2)	250,000
Ripley	120,000
Romford	300,000
Romford (2)	350,000
Rotterdam	850,000
Rotterdam (2)	1,500,000
Rotterdam (3)	750,000
Rotterdam (4)	750,000
Rotterdam (5)	600,000
Rotterdam (6)	2,000,000
Rugby	1,000,000
Rushden	425,000
St. Albans	700,000
St. Gallen	225,000
St. Gallen (2)	225,000
St. Joseph	750,000
San Paulo	700,000
Santiago, Cuba	400,000

	Cubic Feet Daily
Scarborough	800,000
Scarborough (2)	200,000
Scarborough (3)	350,000
Shanghai	225,000
Shanghai (2)	225,000
Shanghai (3)	1,600,000
Sheerness	200,000
Southall	2,000,000
Southampton	800,000
Southampton (2)	500,000
Southampton (3)	600,000
Southampton (4)	100,000
Southgate	400,000
Southgate (2)	500,000
Southport	750,000
Southport (2)	900,000
South Shields	650,000
Stafford	500,000
Staines	600,000
Stettin	880,000
Stockholm	1,500,000
Stockholm (2)	1,750,000
Stockport	600,000
Stockport (2)	600,000
Stockport (3)	400,000
Stockport (4)	400,000
Stockton	500,000
Stockton (2)	250,000
Stourbridge	500,000
Stourbridge (2)	500,000
Swansea	750,000
Swansea (2)	1,000,000
Swansea (3)	450,000
Swindon	300,000
Swindon (2)	450,000
Sydney	1,000,000
Sydney (2)	1,000,000
Sydney (3)	1,000,000
Sydney (4)	1,000,000
Syracuse, N.Y.	850,000
Taunton	225,000
Taunton (2)	350,000
The Hague	1,000,000
The Hague (2)	500,000
The Hague (3)	1,750,000
Tilburg	400,000
Tirlemont	120,000
Tokyo	2,000,000
Torquay	350,000
Torquay (2)	350,000
Tottenham	750,000
Tottenham (2)	750,000
Tottenham (3)	350,000
Tottenham (4)	1,000,000
Tottenham (5)	1,000,000
Tottenham (6)	1,250,000
Tottenham (7)	2,500,000
Tournai	700,000
Tunbridge Wells	1,000,000
Tunis	175,000
Ulm	400,000
Utrecht	1,000,000
Utrecht (2)	1,000,000
Verviers	1,000,000
Vienna	3,500,000
Vienna (2)	2,500,000
Walsall	750,000
Waltham	400,000
Wandsbek	125,000
Wandsworth	1,800,000
Warrington:	
Crosfield & Sons	1,500,000
Warwick	125,000
Wasmuel	500,000
Watford	300,000
Watford (2)	350,000
Weimar	100,000
Wellington, N.Z.	350,000
West Bromwich	550,000
West Ham	1,500,000
West Ham (2)	800,000
Weston-Mare	350,000
Weston-Mare (2)	350,000
Wexford	100,000
Wiesbaden	850,000
Winchester	225,000
Winchester (2)	125,000
Woking	400,000
Wolverhampton	1,500,000
Zwolle	200,000
Zwolle (2)	200,000
Zwolle (3)	700,000

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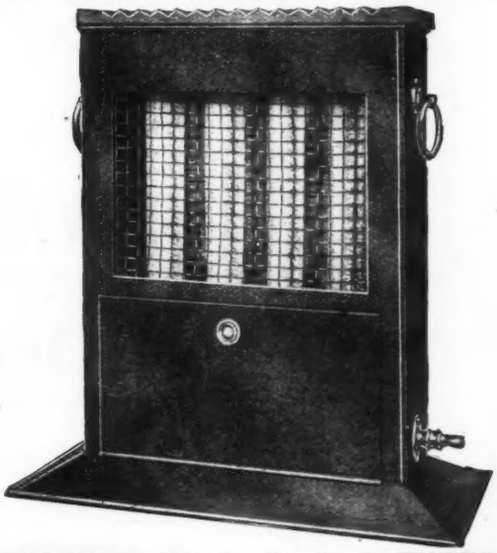

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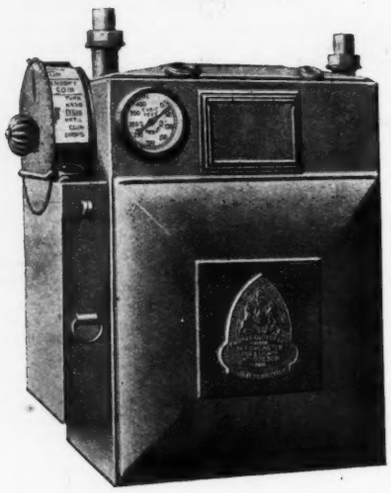

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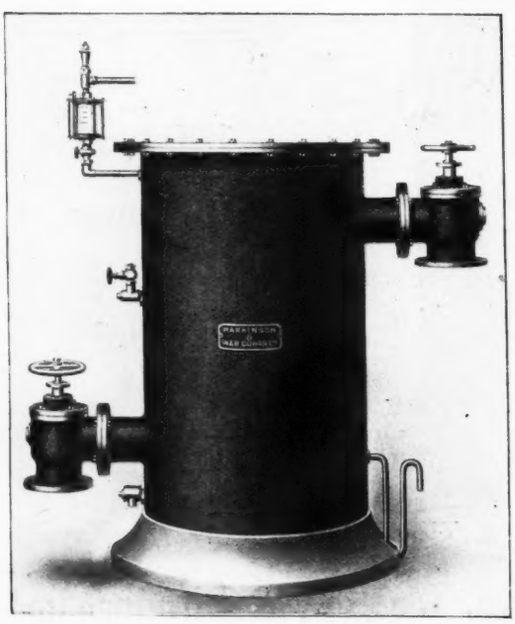

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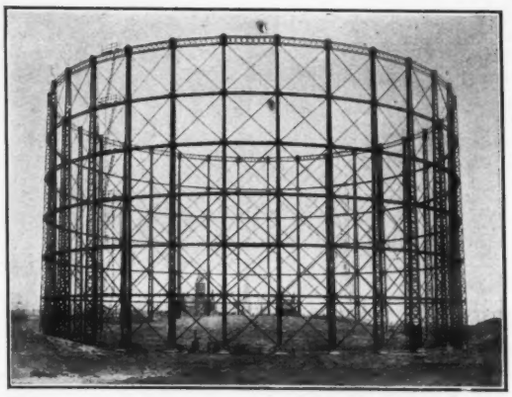

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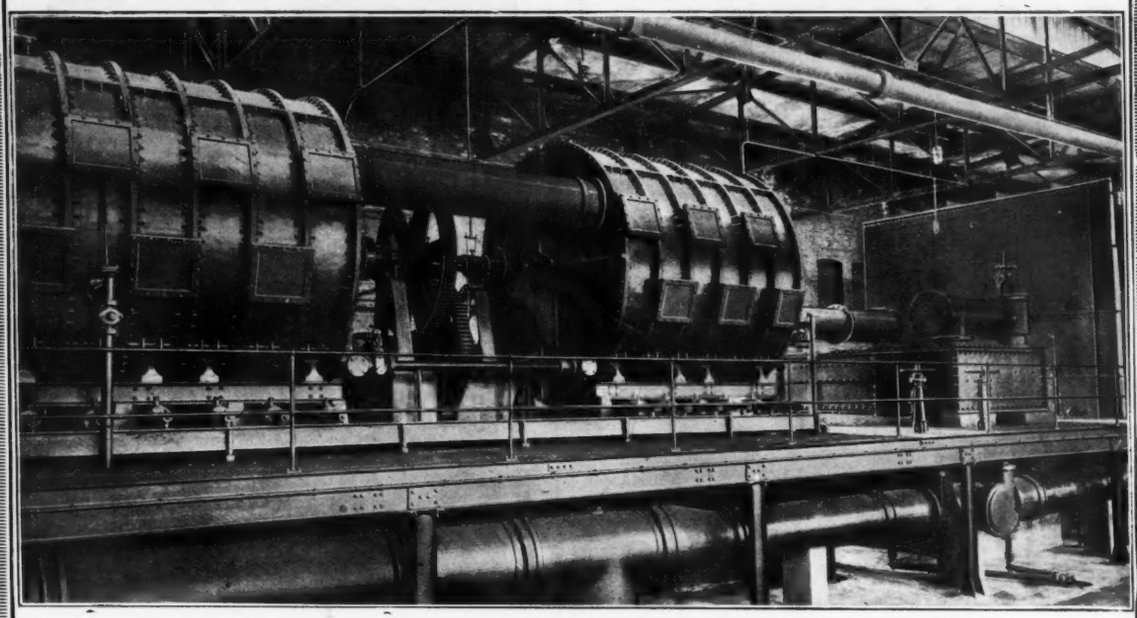

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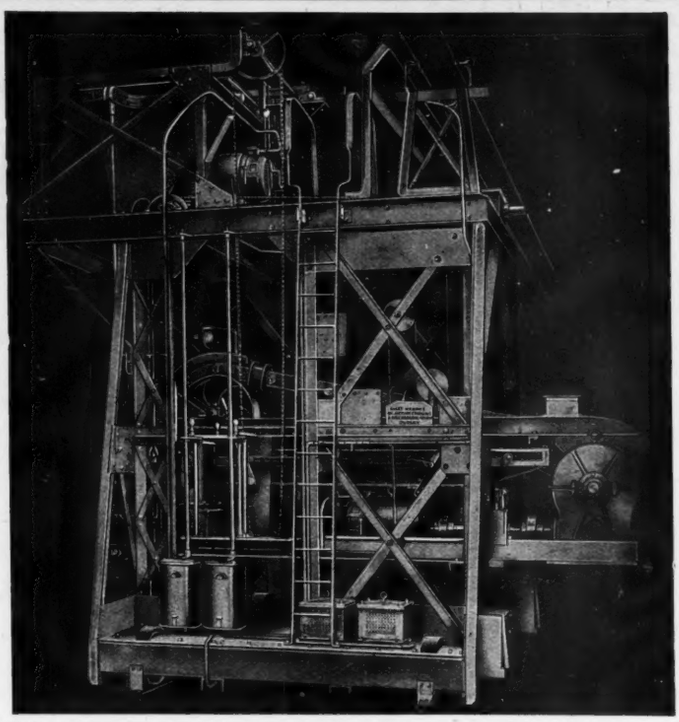

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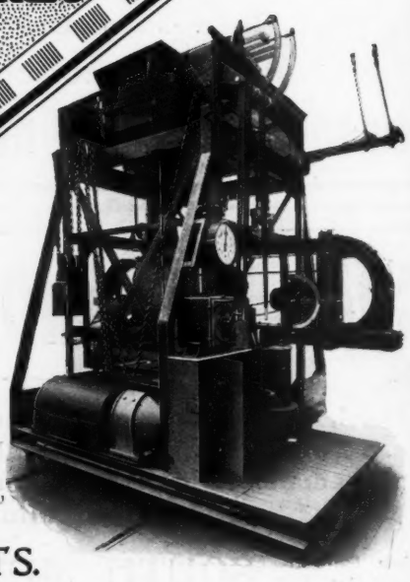

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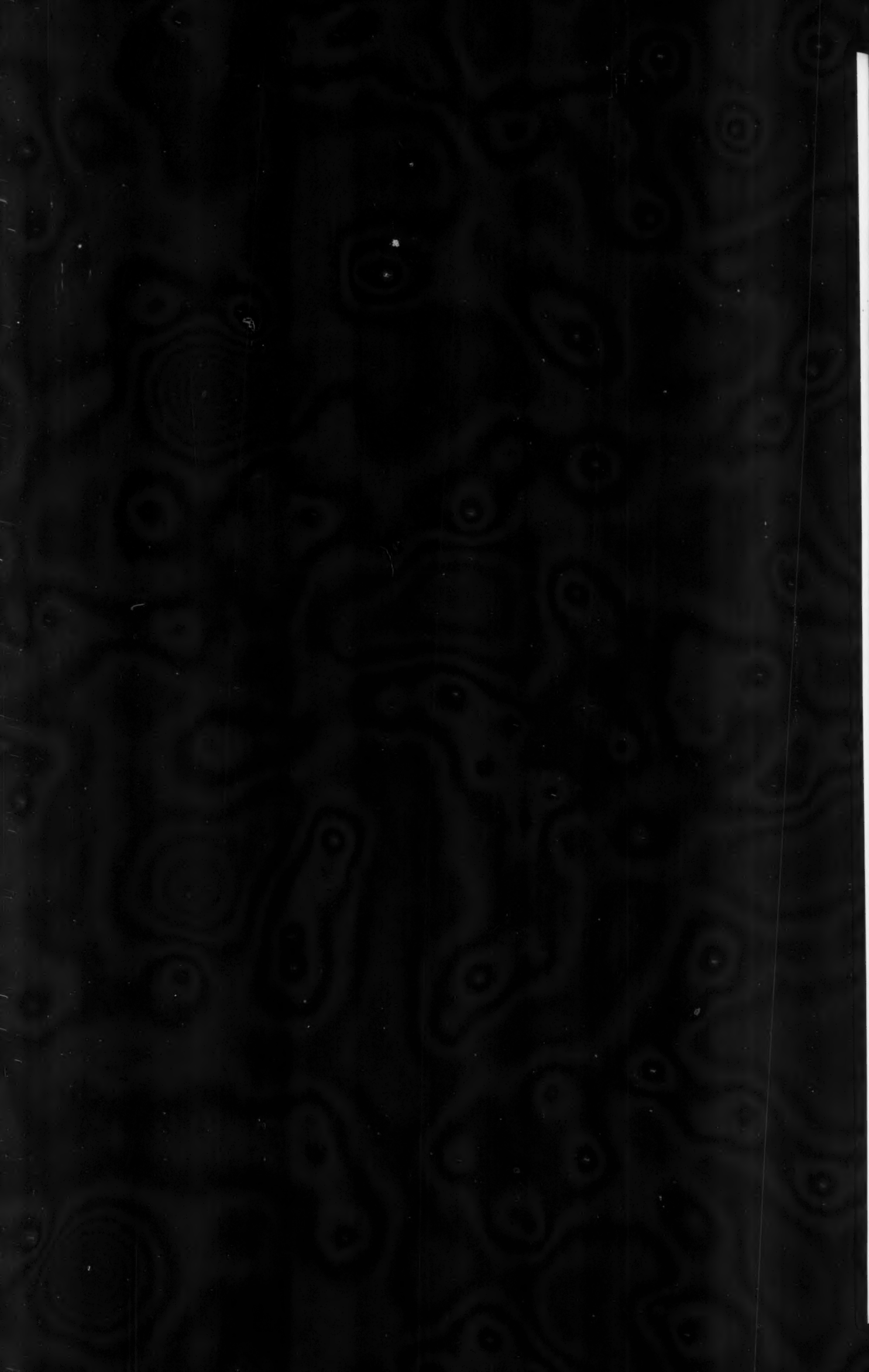

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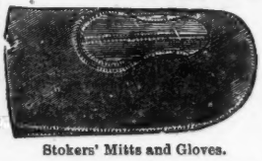

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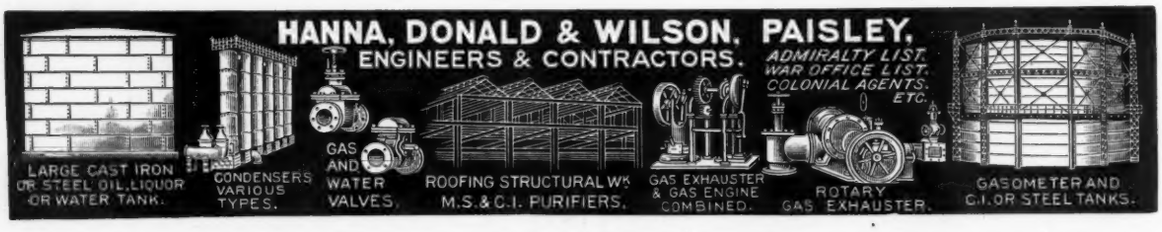
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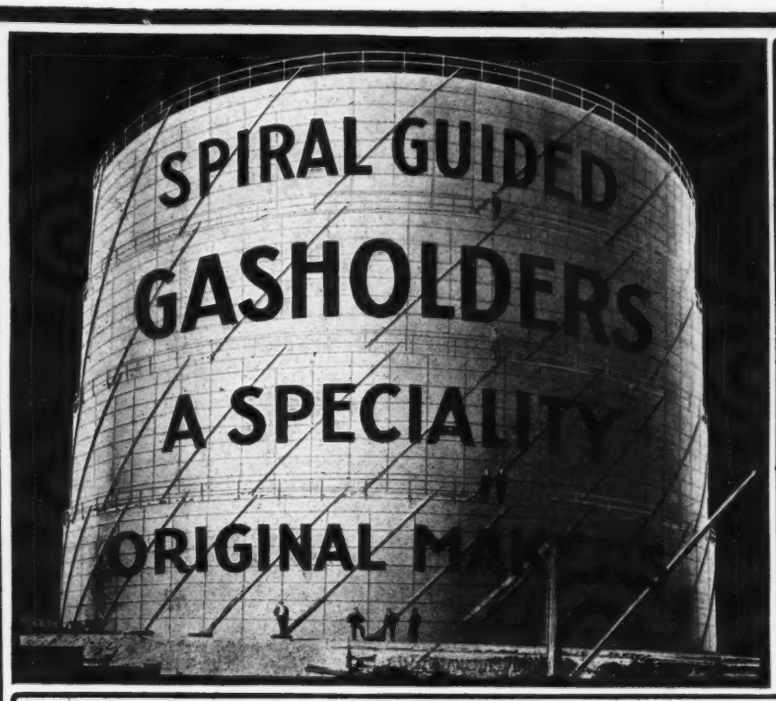

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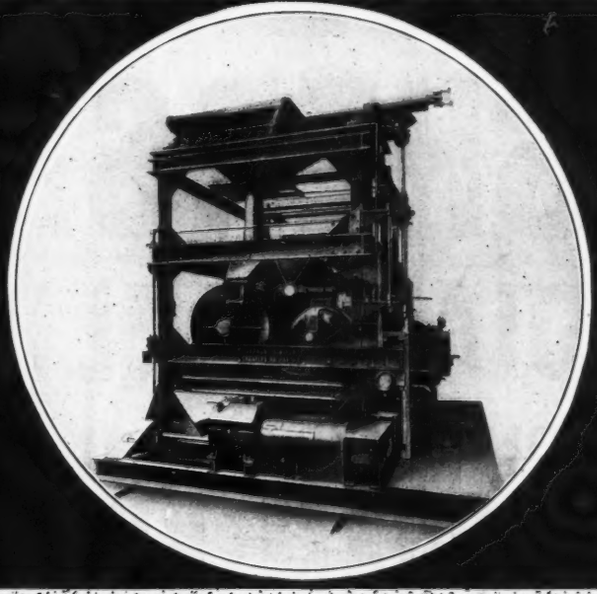

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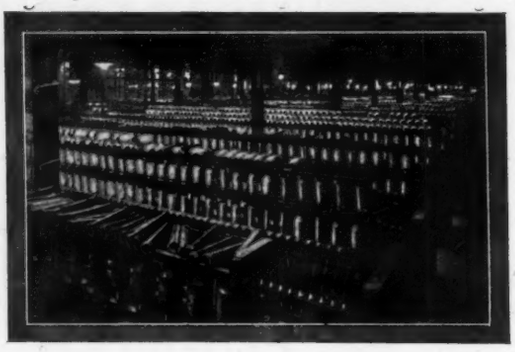

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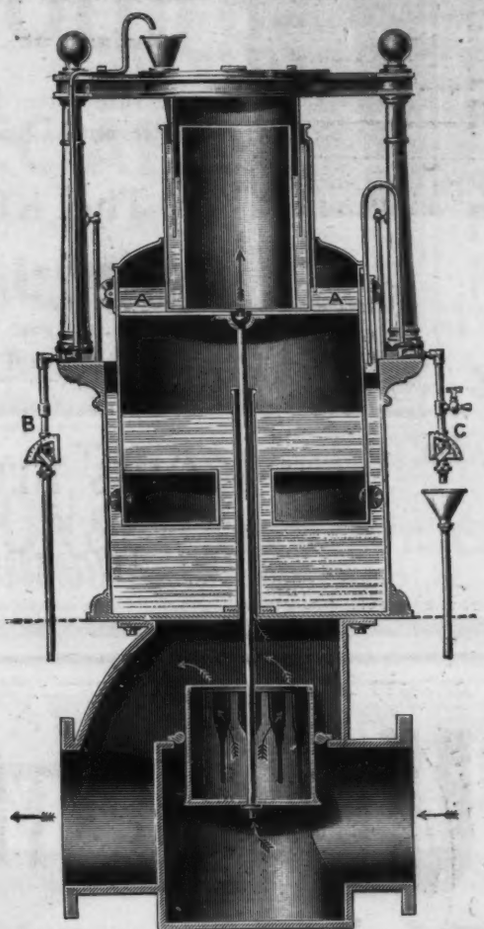

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